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Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

March Meeting, Society of Gas Lighting.

OFFICE OF THE SECRETARY, March 1, 1895.

The March meeting of the Society of Gas Lighting will be held at the works of the Mutual Gas Light Company, of New York, 11th street and Avenue D, on Thursday, the 14th inst., at 3 P.M.

FRED. S. BENSON, Secretary.

[OFFICIAL NOTICE.]

March Meeting, Guild of Gas Managers.

OFFICE OF THE SECRETARY, Feb. 28, 1895.

The March Meeting of the Guild of Gas Managers will be held at Young's Hotel, Boston, Mass., at noon of Saturday, the 9th inst.

A. K. QUINN, Secretary.

[OFFICIAL NOTICE.]

Eleventh Annual Meeting, Ohio Gas Light Association.

OFFICE OF THE SECRETARY, COLUMBUS, O., February 27, 1895.

To the Members of the Ohio Gas Light Association: The eleventh annual meeting of this Association will be held in the parlors of the Arcade Hotel, Springfield, O., March 20th and 21st, 1895, for which occasion the following papers will be prepared:

"Changing the Arrangement of a Retort House, and the Practical Benefits Derived Therefrom," by Mr. A. F. Nash, Windsor, Ont.

"Prepayment Gas Meters," by Mr. Jno. D. McIlhenny, Phila., Pa.

"Cannel Coal as an Enricher," by Mr. Graham Macfarland, Louisville, Ky.

"Incandescent Burners," by Mr. H. Wilkiemeyer, Evansville, Ind.

"What Proportion Should Holder Capacity Bear to Maximum Output?" by Mr. E. T. McCormack, London, Ohio.

"The Growth of a Gas Plant," by Mr. E. C. Gwyn, Springfield, Ohio.

Members are requested to come prepared to take active part in discussions of the foregoing, and of the "Question Box" also, to which they are asked to contribute. The meeting will open at 10 A.M. Wednesday, March 20th. Headquarters will be at the Arcade, but first-class accommodations can also be secured at the Lagonda House, at both of which places special rates will be made for members of the Association.

Application blanks for membership can be secured of the Secretary, who will be pleased to give any information desired.

A. P. LATHROP, Secretary.

BRIEFLY TOLD.

THE SECOND ANNUAL MEETING OF THE MICHIGAN GAS ASSOCIATION.—The second annual meeting of the Michigan Association was held, according to the official notice, at Saginaw, Mich., on the 20th ult., and the report of the convention, now in our hands, shows that the sessions were in every sense successful. The parlors of the Hotel Vincent, which answered admirably the purposes of a meeting room, gave accommodation to a round number of Michigan's gas men, 15 different

Companies in the State being represented at roll call, and five other Companies made successful application for membership in the active class. The associate class was increased by five names, too; in fact, the only notable defection from representation was in the failure of the Detroit Company to send a delegate. The address of the President, Mr. Sedgwick Dean, of Owasso, was a revelation, in that the gentleman composed his message on lines that bristled with independent thought, well digested and harmoniously built up. The paper list had not a missing number, so far as the Association was concerned, although one of them will be "lost" to our readers, since Mr. Walker's paper on "Opposition Companies," although read at the meeting, will not be published in the proceedings. The suppression fact, however, must not be charged to Mr. Walker, but to the President of his Company (the Port Huron) instead. The other papers were well received, particularly that by Mr. Douglas, of Ann Arbor, on "The Heating Effect of Artificial Lights." The Association voted to have only a synopsis of the proceedings printed, and the authors are to say whether their papers shall be printed or not. All the authors, save Mr. Walker, who really was not a free agent in the matter, as explained above, gave their consent to publication; and it is accordingly all the greater pity that the Association saw fit to abridge the ensuing discussions. Appropriate resolutions respecting the memory of the late Mr. Thomas Dwight Gilbert, of Grand Rapids, Vice-President of the Association, having been adopted, the election for officers for the year resulted as follows: President, Mr. H. D. Walbridge, of Grand Rapids—a very thoughtful and well-timed selection, since the gentleman had for years been Mr. Gilbert's coadjutor in the Grand Rapids Company; Vice-President, Mr. W. M. Eaton, of Jackson; Secretary and Treasurer, Mr. Henry H. Hyde, of Saginaw—a well deserved re-election; for that estimable son of his father was unremitting in his efforts to promote the success of the meeting, and was well repaid when it was known that success had been the Michigan's portion. The next meeting place is to be Jackson, Mich., the home of the Vice-President-elect. In taking leave of the subject here (we regret that the synopsis of the proceedings was not received by us at a time earlier to permit of our publication of a lengthier installment than that in our current number) we have to congratulate the Michigan youngster for vitality, and to acknowledge our indebtedness to Secretary Hyde for courtesies extended.

SECRETARY LATHROP'S ANNOUNCEMENT.—Secretary Lathrop's announcement in this issue concerning the year after the Ohio Association's Tin Wedding rather goes to show that the Buckeye gas men are able to hold up a flaunting banner, despite the "hard times" of the depressed last half of '94; for it is an open secret that the smaller gas companies of Ohio suffered in greater proportion during those ill-starred times than did the companies of any other State. The paper list is imposing, and, better still, diversified; wherefore it may be taken for granted that the usual instructive meeting is to be carried through at Springfield on the appointed days.

FAIR PLAY FOR THE GAS INTEREST.—The legislators, or at least the better portion of them—and, all the better, because the best appear to be in the majority—seem to have experienced a change of heart in dealing with the gas interests. Whether our speculation in this regard is accurate and truthful, or the reverse, rests on the report which we make herewith. In the first place the Senate Committee for the District of Columbia, which has been wrestling for months with a proposition to oblige the Washington Gas Light Company to cut its rate to $1 per 1,000 cubic feet, reported adversely, on the ground that the Company was doing its very best under the conditions that confronted it to supply gas cheaply and keep its works up—the latter point being the one that carried the most weight; and it is one which we would respectfully suggest to our electrical friends that they should pay due attention to. In New Jersey the Committee on Municipal Corporations, or a majority thereof—and, by-the-way, the Senate Committee of the District of Columbia was divided, in the sense of a majority and minority—reported against the Gruber measure proposing to reduce the gas rate in certain cities to $1 per 1,000, on the ground that the common sense of the capitalists (including as such some of the men most prominent in the civic, religious and commercial life of the State), would keep the rate at a price which would save their interests from the attacks of other "civic, religious," etc., persons, disposed to gain an honest dollar by or through competition. In New York, too, the handwriting is on the wall that spells the defeat even of Senator Coffey's measure; although two out of every three gas men, non-residents of the City of Churches, would not sorrow a bit if some or all of the Brooklyn late gas belligerents had to pay the piper.

[OFFICIAL REPORT.—REVISED BY THE SECRETARY.—CONTINUED FROM PAGE 260.]

TWENTY-FIFTH ANNUAL MEETING, NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

HELD AT THE PARKER HOUSE, BOSTON, MASS., FEB. 13 AND 14, 1895.

FIRST DAY—AFTERNOON SESSION.

ELECTION OF OFFICERS.

Mr. Allyn, of the Committee to Nominate Officers for the ensuing year, submitted the following names:

President—Mr. Charles D. Lamson.

Vice-Presidents—Messrs. Samuel J. Fowler and W. R. Addicks.

Secretary and Treasurer—Mr. Charles F. Prichard.

Directors—Messrs. J. A. Coffin, F. S. Richardson, C. D. Sherman, W. A. Learned and N. W. Gifford.

On motion of Col. Armington the report was received, and on motion of Mr. Neal, Col. Armington was instructed to cast the ballot of the Association for the election of the office bearers named in the report of the Committee. Col. Armington having cast the vote reported the result of the balot to the Association.

President Nettleton said—Gentlemen, I have the honor and pleasure of presenting to you as your next President one whom you well know, and one whom you esteem highly—Mr. Charles D. Lamson, of Worcester. (Applause.)

Mr. Lamson—Mr. President and gentlemen of the Association: I thank you very much for the honor you have done me. You know very well that I am no speechmaker, but if Grandfather Armington will be my sponsor I will serve you for the coming year to the best of my ability.

Col. Armington—Mr. President, I have merely to say this: My friend Lamson is, as has been said, a very modest man, or else he would not have made the remark that he has. I have been acquainted with the gentleman for many years, and although I am approaching 50 very fast, I really believe, from the efforts he has heretofore made and the progress he has shown in the prosecution of this business, that he is certainly the right man for the Presidency of the New England Association of Gas Engineers.

The President—I am quite sure we can all agree heartily to that statement.

The Association then adjourned to Thursday, February 14th, 1895, at 10 A.M.

SECOND DAY—MORNING SESSION.

The Association met pursuant to adjournment.

The President announced the first business would be the reading of the paper by Mr. W. A. Wood, entitled "Notes."

Mr. Wood said that he took simply one note for consideration, as it was the only thing he could find in looking over his records which he thought would be particularly interesting, for in the short time given him he could not prepare anything very elaborate. He then read this "note" on the

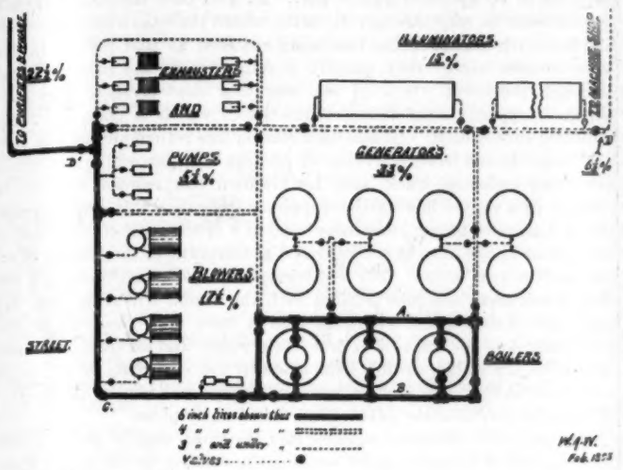
DISTRIBUTION OF THE WORK OF BOILER FUEL IN WATER GAS MANUFACTURE.

Fuel figures, as commonly given, comprise two items, generators and boilers. The determination of the proportional parts of the latter factor with reference to the amount required or absorbed by the different pieces of apparatus is, under ordinary arrangement of piping, impracticable. The steam plants at the North End station of the Boston Company include three 200-horse power Hazelton boilers, and steam is transmitted through some 2,200 feet of main piping—planned to meet the demands of a station covering eight acres of territory, with an ultimate daily producing capacity of 6,000,000 cubic feet. The steam distributing mains are made up of 500 feet of 6-inch, 900 feet of 4-inch and 800 feet of 3-inch. The accompanying sketch shows roughly the position of the apparatus relative to the boilers, and a plan, not drawn to scale, of the main steam lines. The 3-inch extensions to wharf on one side and machine shop on the other are not shown.

It will be seen from the plan that we have a circulating system—the only dead ends branching from the points D^1 and D^2—the former running across a 60-foot street to the purifying houses and hoisting engines on the wharf, and the latter extending 250 feet to the machine shop.

This gives a double line of supply to each important piece of machinery and the apparently superfluous duplication of pipes has proven of great value in more than one instance. Leaky joints can be tight-

ened, valves replaced and cleaned and additional connections made at any time without shutting down. I have endeavored to avoid detail in the sketch, and, by exaggerating the size of pipes and valves, to show at a glance how the use of steam from either boiler may be confined to a single element of the plant while the remainder of the battery is running the rest of the apparatus. Under these conditions it becomes easy to determine, without disturbing the uniform rate of running, the amount of fuel required to furnish steam to different parts of the plant.



A series of experiments on the above lines were made, extending from November 3 to November 8, 1894. Separate determinations were made by 24-hour runs on generators, purifiers, blowers, illuminators, exhausters, and machine shop.

With the blowers was included the feed-water pump; with the purifiers, the engine running the wet lime mixers and agitators, the oil pumps and the heating of office, purifying and meter houses; with the exhausters, three pumps for handling condensation.

The fuel used was Lackawanna pea coal. Gas made per hour was uniform throughout the six days' test, the atmospheric temperature ranging from 30° to 62°.

A summary of results obtained is as follows: Of total boiler coal used there was required by

Generators	33 per cent.
Purifiers	22½ " "
Blowers	17½ " "
Illuminators	15 " "
Exhausters	5½ " "
Machine shop	6½ " "

I wish to add that I claim no personal credit for any merit in the plan, and also wish to escape any criticism for demerits, should any be discovered in the arrangement of the piping. The system is a combination of the old and new plant. Some of the older pipes—the 3-inch and part of the 4-inch—were put in by Mr. Lamson, and are at least 20 years old. The new system of 6 and 4 was planned by Mr. Addicks when water gas was introduced in 1892.

Discussion.

The President—You have heard a very interesting paper. I think it will strike many with surprise to see steam pipes connected to the gas apparatus in just this way, but I can see very easily that it would be of a great deal of convenience to the works to have them so. Have you any questions to ask Mr. Wood, or any suggestions or criticisms to offer?

Mr. Coggeshall—I would like to ask, taking all the steam used for the apparatus, how many pounds of coal are used per 1,000 feet of gas? What was the average?

Mr. Wood—I will say, in answer to the question, that steam for the generators took exactly 5 pounds of boiler coal. I think from that you can figure out the total amount. It is something like 15 pounds for doing all the work mentioned.

Col. Armington—Were these exhausters for your whole make?

Mr. Wood—Yes.

Col. Armington—I was surprised at the small percentage of the amount of steam required for exhausting the whole make—5½ per cent.

Mr. Wood—That was rather a surprise to us, for at the time I think we were making about 2,000,000 feet. Practically, they absorb less of the boiler fuel than any other portion of the apparatus.

Col. Armington—Then you still continue exhausting the whole of the make?

Mr. Wood—Yes.

The President—Do you use any special means for protecting the pipes where they are under the ground?

Mr. Wood—The only place where the pipes are underground is where they cross the street at D^1. That connection is made up of two 4 inch pipes, for the reason that the street was so filled with large gas mains that it was found impracticable to run a 6-inch pipe across and give it proper covering. The pipe we laid was covered with magnesia covering, and outside of that a galvanized iron covering was soldered on the whole length of the pipe to protect the magnesia covering from dampness. Then the whole thing was put inside a 10-inch pipe crossing the street. A railroad runs over it, and as there is also very heavy traffic, being afraid of breaks, we put in a 10-inch wrought iron pipe for that reason. There are no expansion joints in the system—the expansion being allowed for by the offsets in the pipe. It looks like a straight connection on the plan, but this pipe *A* (referring to plan) is 10 feet lower than *B*, and in coming from the boiler we drop down to it. In the same manner there is a drop at *C* of 3 or 4 feet, with elbows or T's, which allows sufficient play to take care of the expansion. We have had little trouble from leaky joints or straining the fittings, although no expansion joints are used.

Mr. McKay—I would like to ask Mr. Wood whether he finds that that system will take care of the expansion; and also what, in his opinion, is the best material for making flange joints on large steam mains?

Mr. Wood—We used rubber packing on all that work for flange joints. When the line was first put up we had some trouble from the joints leaking. At that time the flanges were connected with bolts, and holes were punched through the rubber, and the joints were made in that manner. The mechanic who had charge of the steam department, when joints gave out, as they did from time to time, replaced the packing with a narrow gasket put inside of the bolts. Since then we have very little trouble with leaks at any point—no more, in my opinion, than would have been the case had expansion joints been used.

On motion of Mr. Fowler, a vote of thanks was given to Mr. Wood.

A Couple of Telegrams.

The Secretary read the following telegrams received from J. R. Thomas and T. F. Rowland:

New York, Feb. 13, 1895.

C. F. Prichard, Sec. N. E. Association Gas Engineers, Parker House, Boston: Many thanks for your remembrance. Success attend your 25th anniversary. Sorry I am not with you. Jos. R. Thomas.

Brooklyn, N. Y., Feb. 13, 1895.

C. F. Prichard, Sec. N. E. Association Gas Engineers, Parker House, Boston: I am exceedingly pleased to receive your telegraphic communication informing me of my unanimous election to honorary membership of the New England Association of Gas Engineers, for which compliment I am profoundly grateful, and beg you to please accept for yourself and convey to the Association my expression of hearty thanks.

Thomas F. Rowland.

The President—The next subject we will take up is the generic one, given in the programme under the title of

ELECTROLYSIS.

Mr. Addicks has this in charge, and we would like him to start the discussion.

Mr. Addicks—I have no paper to present to you, either in behalf of the committee appointed some time ago on this subject or on my own behalf. The subject of electrolysis in Boston has not been a very serious one. I have stated that to the members several times in the past. I would say, however, that we have had no electrical measurements taken of the pipes of the Boston Companies. It is a very expensive undertaking, and until I could show that it was very important the management of the Companies felt that it was not justified. I am going to produce to-day some of the samples that Mr. Allyn showed to you from the Boston services two years ago. The first trouble from the corrosion of any main pipe was discovered this year at Albany street and Dover street, in Boston. I have samples of gas pipes made with cement joints, and samples of gas pipe made with lead joints, and I can show you that there is corrosion in both cases. As far as the question of any definite results or recommendations to the gas fraternity, I am personally not in a position to suggest anything at present with regard to what should be done by gas men. In connection with the subject, I wrote to

Mr. Little, the President of the West End Railroad Company, and suggested that, if it were his pleasure, we would be very glad to hear something from the West End standpoint. Mr. Little referred the letter to the General Manager, Mr. Sargeant, and the Assistant General Manager, Mr. Winsor, has written a short communication, describing the West End point of view, and with the permission of the gentlemen, I will read that communication for him. It was not convenient to have any one from the West End Company come before you at this time, as they are very busy with other work. Previous, therefore, to describing the samples that I have produced, with your permission I will read this communication, which was put into my hands within the last fifteen minutes—you will understand that this is from Mr. Winsor, the Asst. General Manager:

Electrolysis, as it affects pipes in the ground, is the eating away or oxidization caused by electricity passing from the pipe into the wet ground. It takes place only in spots where the conditions are most favorable, and is confined to a very small section of pipe, generally from a few inches to a couple of feet in length.

History of the Trouble.—When electric roads were first put in, and I am sorry to say even as they are sometimes put in and operated to-day, little or no attention was paid to the return of the electricity to the power house. The question of sending the current from the station to the cars was fully understood, but it was taken for granted that because the earth was used for a return by telephone and telegraph companies it would do equally well for railroad currents. If the question had been carefully studied it would have been seen that the question of return circuits was fully as important as that of the supply circuits, but the railroad electrical engineer had his hands more than full with other things. He had to look after his power plant, the pole line and the motors, and he let the returns take care of themselves. He had to, as steam, mechanical and electrical engineer, install and operate large power plants—some of them the largest power plants in the world—to design and erect the buildings to cover them, to install and operate electric generators of before undreamed of sizes, and to design switchboards for controlling them; to calculate the amount of copper required to take the electricity to the cars, and to design all the details of poles, insulators and hangers, and see that they were properly erected; to decide upon motors and controlling devices for the cars, and he often had the tracks and even the cars themselves, the trucks and wheels and axles to look after; and last, but really the most important, to operate the road and keep the cars going day and night. He had no reservoir nor gasholder to help him, and he had to keep the wheels turning all the time. The wonder was that things went at all—that the electric road was not abandoned in its infancy—not that he forgot his return currents and the pipes suffered.

Earlier Methods.—Let me describe some of the earlier methods for returns that were used—some of the earlier roads did not even have a method. The ordinary fishplate with which the rails were joined together was relied upon to electrically connect the rails. Usually a copper wire was run between the tracks, and the rails were connected to these supplementary wires by small copper bonds. Often the rails were the old horse car strap or tram rails, and the ends were so insecurely fastened that the bonds were continually broken by vibration.

Near the power house a copper return, more or less small, was put in to connect the rails to the dynamos. Sometimes this was of fairly generous size, but often it was very small. In one case I know of some old wire taken off a burnt out armature was considered sufficient.

Even with these methods the roads worked and worked well, and the losses on the return circuits, except in the very worst cases, were not large. On the larger roads, such as the West End Street Railway Company, of Boston, the loss on the returns averaged much less than it did on the feeders. On their worst lines three years ago it was but 25 to 30 volts per mile, and to-day it will average less than 10 volts per mile, and is growing less all the time. They are continually putting in more return copper overhead and in conduits, and, what is of much more importance, are improving their track wiring and bonding at every opportunity. They are seizing every opportunity that offers. Whenever a piece of track is opened for repairs the bonding is inspected, and, if possible, new and larger bonds are put in. All new rail laid, whether in a new district or to replace worn out rail, is very heavy, with firmly fastened joint plates, and bonds containing a large amount of copper are put around each joint.

The Earth as a Return.—What is the value of the earth, including all the gas and water pipes, as a return circuit for an electric railway company? Almost nothing.

The resistance of the earth is very high, so high that if a railroad had its power house half a mile from its nearest track and had no wires run from the track to its dynamos, depending on the earth and the pipes for its return circuit, it could not move a car, nor light a lamp in the cars.

If, however, the power house was within a few feet of the track, or if it had a good metallic return, except for a very short distance, the cars could be operated fairly well. In this case the return current would force its way through the earth where the return metallic circuit did not exist, almost all the loss being centered at that point. In this case trouble would very quickly develop where the current passed through the earth. It is in this way that electrolysis of pipes takes place. Suppose a road with a return circuit which is poor, but fairly uniform throughout. In a certain section this return circuit gets very bad, some bonds having broken, or perhaps the gas and water people have dug under the track, and, for his own convenience, the man in charge of a shovel has cut the supplementary (and this has happened more than once to my knowledge) and as a result most of the force of the power house may be concentrated at this point in the attempt of the current to run home. The electricity will be forced through a few feet of wet earth to a pipe parallel with the track, will flow along the pipe, and at some point where the pipe is very near the track beyond the break, and the ground is wet with water and saturated with ammonia from a stable, or filth from a sewer, the electricity will find its way back to the track and, in leaving the pipe, will rapidly eat it away. This is the way electric railway currents destroy pipes.

Safeguards.—To guard against this we must supply good metallic returns, either by thoroughly bonding the rails, or by the use of wires, either overhead or underground, and by so arranging the returns that a failure of a bond, or the breaking of a wire, cannot materially lessen the value of the returns at the place where the break occurs.

Let me describe how the West End Street Railway Company is now building its return circuits. All new girder track weighs 93 pounds per yard. At each joint two copper bonds are placed, each bond consisting of two strands of No. 00 copper wire. On a double track street this gives four rails, each joint with four strands of No. 00 copper wire, or 16 strands to the street, these bonds being equivalent to four and one half 500,000 circular mils copper cables.

To guard against even a partial break weakening this return circuit the rails are cross connected by a 500,000 circular mils cable every two or three hundred feet.

Track special work is bridged by one or more 500,000 circular mils cables to each track, depending upon the location, so that a frog or switch can be replaced without disturbing the return circuit. Where the track is tram, or has only an old and poorly bonded rail, overhead or underground cables are run, connected to the track at frequent intervals. In the immediate vicinity of the power house a large amount of copper is run connecting these various returns to each other and to the station.

Result.—There has not been for more than two years to my knowledge a case of damage to gas or water pipes by electrolysis in the district in which the West End Street Railroad operates.

In conclusion, the whole question of electrolysis is now so well understood by competent electrical engineers that there should be no more fear of trouble from this source. The remedy is within their reach and is being, or has been, applied by most of the electric railroad companies.

Discussion.

Mr. Addicks—I think the fact that the West End Company puts this statement into the hands of a member of the fraternity certainly shows the faith they have in what they say.

The President—I think we are very fortunate to have this statement from the West End Railroad Company. It seems to me, as I have listened to it, that it is very clear and concise, and brings before us, fairly and fully, the railroad's side of this question. We are very fortunate to have with us to-day Mr. Crockett, of San Francisco. If he will kindly favor the Association with a statement of his experiments, and of the results he has reached, it will be a favor to us.

Mr. Crockett—Along the tracks of the electric companies we were bothered a great deal by electrolysis, and having been in receipt of samples of pipe from all sections, were very desirous of making tests to find out exactly what the conditions were. We employed two experts in electricity, gave them a gang of men, and sent them over the routes that were at that time operating under the trolley system. The first road built by the Metropolitan Railway was one intended to run in the suburbs of San Francisco, and was built as cheaply as possible. When we began our experiments on that road, we opened up at every corner and took the number of volts we found from the rails to the pipe, and from our pipe to the water pipe, to see whether there would be any dif-

ference between the two pipes. We found whenever a car came along that we could get as much as 11½ volts, and that as soon as the car passed it would drop down to 4 volts. The difference between our pipe and the water pipe was very slight; it ran down possibly to less than half a volt practically. As soon as the railroad people discovered we were making this investigation they immediately set a gang of men at work night and day, and began to bond their rails better than they had been done before. They dug up every joint. They had originally only a single No. 0 wire, and they dug up their joints and put in two. That, of course, blocked our experiments in a way. We then went over the water pipes. There was a 40-inch water pipe coming in from the main reservoir—there had been much trouble with the water pipes—and when we began to look them up we found they were being eaten out in every direction. For 300 feet that pipe was totally destroyed, and had to be taken up and replaced. Up there we made an accurate experiment. We did not take a measurement from the rail, but as there was a little pond of water there we put one end of a wire on the pipe and the other end in the water, and got half a volt right off from the earth—showing, of course, that we were beginning to get the effects of electrolysis right at that particular point. When we tried the other lines we found that they had been built more recently, and had used No. 00 wire all the way through. On that line we discovered very little damage, and got very little voltage; but we could discover an electric current all through it. Then, towards the far end of the city, we wanted to find out whether the dead ends were carrying any electricity. Blocks away we found that the meter would begin to register a little, showing that there was a current still passing through that pipe. As to this remedy which has been suggested—I think it a very good one, so far as our experience goes, but I do not think it is a sufficient one. The Railroad Company immediately began to construct two more roads there, and when the time came they bonded their rails with three wires. I noticed, too, a very peculiar thing, which was that wherever they crossed their own cable car track they put in five wires. I asked them why they did it, and they said they did not know really why, but thought it was better for them. I told them I wished they would do that on our pipe. But so far there are only a few locations where we have suffered any actual amount of damage. In a location that was rather swampy we could see a change in the fiber of the iron almost immediately after it was put in—the outside of the pipe began to go, and the fiber was eaten out. You could see the unmistakable color where the electricity was acting, giving the iron a sort of bluish tinge. In Salt Lake City, where they run the water all through the city along the edges of the streets, they are having a great deal of trouble, because the ground is so moist. In Oakland (opposite San Francisco), where it is all sand and it is very dry, they have suffered no damage at all, and are running more electric cars than in any place I know of. I do not see any better way of preventing electrolysis than by bonding the rails in the way that has been described. I have a very large amount of data, but unfortunately cannot remember it all. We spent three months in investigating this thing, and I have a report of about 90 pages of typewritten matter, but it is a little too lengthy for me to remember.

The President—I am sure we are all under obligations to Mr. Crockett for his kindness in giving the result of his investigations. I think we have all suffered more or less from this thing. Those of us in country towns have suffered less, while in the large cities there has been a great deal of trouble.

Mr. Allyn—Does the gentleman connect his pipes with cement or with lead joints?

Mr. Crockett—Our joints are altogether lead.

The President—We would like to hear from Dr. Amory on this subject.

Dr. Amory—I am not familiar with the subject practically, but I think that Mr. Addicks has perhaps given rather a false idea with regard to the cause of electrolysis, and the condition of the earth as a conductor. Moist earth is one of the best conductors known in the world, and Mr. Crockett has called attention to the fact that where the soil was moist they found the contact injured the pipes most seriously, as also in soft clay. I think some of the journals have mentioned recently that the electrolysis of pipes was due as much to the contact of the pipes with the moisture and saline materials in the earth as to any other cause, and that the action is not a direct action between the wires and rails of the road and the pipes of the gas or water company, but is due to the indirect action of soil which is wet, or which has salt or saline material in it. I think that is pretty well understood now among all electricians, and it is also entirely in accord with the action of the electrolysis with which we are familiar in the laboratory. If you pass a current of electricity through pure water—or try to do so—it does not conduct, nor is the water broken up. But if you put in a drop or two of sulphuric acid, or any saline material, such as sulphate of zinc or chloride of sodium, the water is then broken up into its component parts, oxygen and hydrogen; but of course during such a chemical action as that the action of the elementary iron is also involved in forming a base, which results in the destruction of the metal element iron. I think the confusion on the subject is probably due to the fact of the faulty connection of the rails, which Mr. Addicks has so carefully discussed. Where there is interruption to the contact through the rail, of course the current of electricity will pass through to the earth, and it will always seek a moist part, and especially a water pipe in preference to a gas pipe, because the water pipe has water in it and is placed deeper than the gas pipe. It also takes the gas pipe when in its path, and prefers that course if the soil is not moist. Mr. Crockett has called attention to the fact that at Oakland, where the soil is sandy and dry, they have had very little trouble, which is in line with the criticism I have made.

Mr. Addicks—Was Dr. Amory present when this question was opened?

Dr. Amory—I heard you read the paper by the Assistant General Manager of the Railroad Company.

Mr. Addicks—I entirely agree with all that Dr. Amory has said with regard to moisture, and more particularly with his statement that in a place which is permeated with salt water, the pipes will be affected more rapidly than where there is pure, fresh water. I think but very little can be added to the very excellent report of the committee of which Mr. Thompson was Chairman, made to the Western Gas Light Association. I think that very few committees ever took up a subject and went into it so thoroughly as that committee did. You are all probably familiar with Mr. Farnham's paper. I would also call your attention to the papers written by Messrs. Charles A. Stone and Edward C. Forbes, on the "Electrolysis of Water Pipes," read before the New England Water Works Association, at the meeting held June 14, 1894, in Boston. Also to the "Eighteenth Annual Report of the Boston Water Board," by Mr. Jackson, the Engineer, in which that matter is considered. The city of Boston is spending a great deal of time on the subject, and I trust we may take advantage of their labors later on. I have reproduced for you a table made by Mr. Jackson, and which he has very politely allowed me to reproduce for you from the report I have just cited. This is a table in two colors—red and blue—indicating the difference in voltage between water pipes at different points, and I will illustrate that in connection with the map of Boston, because the names of the streets are probably not familiar to you all. The red shows the difference in potential between the water pipe on Sumner street at the corner of South street, and on Harrison avenue at the corner of Bristol street. *This* (pointing on map) is the power house of the West End Road. The blue line represents the difference in potential in the water pipes at Foster's Wharf, and the same point at Harrison avenue and Bristol street. Where I have experienced difficulty with the gas pipes in Boston is at *that* point. One space, as from *here* to *here*, represents one hour of the day; so that this whole space represents a little more than 24 hours. The space from *that* point to *this* represents two volts; the maximum being 16 volts. You observe that at 1 P. M., in the day time, the voltage starts up, and then it runs at a moderate degree to the maximum at three o'clock; then it falls off; and at the time the people are going home, between five and six o'clock, the maximum is reached. Then after six o'clock, it falls off; until at 7 or 8, the time people go to the theatre, it rises again; then falls off again; then rises slightly, between 10 and 11 o'clock, when the cars are taking people home from the theater; and then it falls off again at about 12 o'clock; and during the early morning hours it is down as low as 1 volt. The people evidently go to their work at 6 o'clock, for then it runs up to 6½ volts; and then falls off again; and then, from 7 to 9 or 10 o'clock, it rises to a high point again; and then is moderate again until 1 o'clock. You will observe that the maximum difference of potential is 15 volts, and the minimum is about 1 volt. The red line, you will observe, indicates a point taken nearer to the power house. Going away from the power house you observe that the blue line slightly increases in voltage. I want again to call your attention to the fact that our difficulty in all these cases that I have had—and in the only cases I have had in Boston—are within this short distance *here*. The scale on this map is 500 feet to the inch. You will observe that *that* distance is 1,500 feet. In that connection I would call your attention to what Mr. Farnham said in his paper with regard to concentrating the trouble near the power house, I will call your attention to another feature of this map. The white indicates the solid ground of Boston. You observe how small in propor-

tion is the solid ground of Boston proper. All the rest is filled-in ground, and a great deal of it is this peculiar dock mud, which is very pronounced in the vicinity of Harrison avenue. I call your attention also to the statement made to me that in South Boston a great deal of the current returns from South Boston through the water of South Bay. That may have something to do with our troubles at *this* point. I have mentioned that I was all in a fog with regard to this question ; but I meant only in regard to what joint is the better joint to use. I thought that the cement joint gave a higher resistance, and that it was better to make the gas pipes of higher resisting material and let the water pipes take the current. I think that Mr. Thompson, in his discussion of Mr. Farnham's paper, mentions that fact—*i. e.*, the value of high resistance joints. Now for the samples of pipe which I have brought as illustrations. We happen, on Albany street, to have two mains, which was an unfortunate duplication of mains by rival companies. I am speaking now of only the Bay State and the Boston. One main had cement joints, with occasionally a lead joint, and the other had all lead joints. *This* is a sample of the cement joint pipe. I do not know whether you can distinguish how this is all eaten away around the bell. It is as though water had been rushing over it for a long time. You often see rocks eaten away by the action of water in that peculiar way. A closer examination will show that in a number of places it is pitted. *Here* it is all gone. Later on, perhaps, a closer examination will be more satisfactory. *Here* is another piece of the same pipe. If you will examine it you will find that there is no thread left on that service. The services of this pipe were never run. The main had never had any gas in it—thus showing the value of the duplicate system. *Here* is an elbow, showing the condition in which it was in *this* pipe on the west side of the street. Pipes were tapped for service connections opposite each house. In *this* case the service was not run. In *this* case you will observe that not only is the elbow all gone, but it had eaten straight through the plug. At the time that was fresh I could whittle that plug with my knife. It was the same way in pipe removed from India street. Here is another specimen showing the same thing. It was not a single case, but there were a number of cases like that. I do not know just how many services there were in that main.

Col. Armington—Were those specimens you have shown very near this power house?

Mr. Addicks—Yes, they are all from within 1,500 feet of the power house, and were lead-jointed pipes. Here is a piece of cement-jointed pipe which, on the first examination, was entirely free from trouble, but later on I happened to tap this with my knife, and scaled off some outside scale on the pipe, and you see that you have that same peculiar condition which you find on the lead-joint pipe. You will observe likewise that I have no cement-joint bells here. They were perfectly good. You will observe that pitting is not on the joint, but just beyond it—which would probably carry out the theory that there being more resistance at the joint, it left the joint and came back to the pipe. *This* is a piece of cement-joint pipe which is the worst specimen I have, and came from the corner of Dover and Albany streets. The pipes there (*i. e.*, those just shown) run in a direction towards the power house. This was a cross connection from these same pipes. You observe that is all gone *here*, all the way around. If I had a hammer I could knock off pieces of the pipe. All through here it is in a very bad condition. With a knife you can chip off pieces of rust. With regard to the length of time these pipes have been laid, I may say that *this* piece of pipe was laid in 1872 ; it is a piece from Dover street, with cement joints. *This* piece of cement-jointed pipe which I showed you was laid in 1879. It had 10 lead joints in 3,868 feet. The Bay State pipe was laid in 1885. That is the one from which these pieces of elbow came. I have one further interesting specimen to show you. *Here* is the one (3-inch service) which was shown by Mr. Allyn some time ago. That pipe was put in about 1872, as far as I can learn. At that time they did not make any record of their new services, but the tee for that service was put in about 1872, and I have no means of knowing whether it was ever relaid, but am inclined to think it was not. It was taken up on February 16, 1892, and was replaced by a piece of kalamine pipe. You will see what happened to the kalamine pipe. Here is a piece of it. It was put in on February 16, 1892, and departed life August 18, 1892. It did not live very long. That is its condition in that short time. That was again replaced by a piece of wrought iron pipe. *This* is the piece of wrought iron pipe. There is a piece of that kalamine pipe still in service, I believe. *This* was put in August 20, 1892, and this small section was removed for examination on October 10, 1894. That is the effect on that pipe after two years' service. The condition of the pipe is similar to what Mr. Crockett describes. That examination was made last August. *Here* is another piece of the pipe which has been in still longer; and *here* is a piece of pipe which replaced the short piece which I just showed you. That piece is as good as the day it was put in. To be sure, it has not been in very long—only since October 11. That piece was painted with red lead when put in, and you can still see some of the red lead. It might have been put on very poorly, and finally wet. When put in the dirt may have taken the red lead off, but, so far as the effect upon the pipe is concerned, I can find no effect of the electricity on this piece of pipe since October. That is a little history of the service at *that* point, which will be followed out further, and we may know more about it next year. The experiments and work at present on the new services have cost the Gas Company $87 on that service. Let us hope there are only a very few more of its kind left. This is all a very disconnected statement, but I could hardly bring it together, with all these samples, and do it in a much better way.

The President—You will all agree that even if the Committee on Electrolysis have not presented a written statement, they have presented a most interesting report, and the thanks of the Association are due to Mr. Addicks for the time he has put into it, and for the report which he has made.

Mr. C. S. Spaulding—I would like to ask Mr. Addicks if the pipes were all taken on a line of the car tracks, or off on some side streets?

Mr. Addicks—I am very glad that question is asked, for it reminds me of something I had intended to say. There are no car tracks in Albany street, and yet that is where this difficulty occurred—so far as concerns the lead joint and cement joint pipes which were laid parallel—and it is where *that* service came from. In case of the specimen from Dover street, I may say there are car tracks there which have been out of use for a long time on account of the rebuilding of the Dover street bridge. I had occasion on account of a broken main to examine the pipe only one block from Albany street—that is, on Harrison avenue—which has car tracks on it, but over which no cars are running. It was a 9-inch pipe, and was located at Harrison avenue, where it crosses the Boston and Albany Railroad. I have no record of when that pipe was put in ; but although it is a very old pipe, it is in as good condition today as it was the day it was put in. Still, that is only a very short distance from this very point.

Mr. C. S. Spaulding—I asked that question for this reason : A short time ago, when I was connected with the Brookline Gas Company, we had occasion to run a 20-inch main through part of Brighton avenue, and we had 15 or 20 services to cut and to connect with the 20-inch main. This was about 1,000 feet from the car tracks. At the office one day the men said they could not connect their unions, as they got a current which set the gas on fire. Taking a voltmeter and going to the place, I found between the main and the service to the house a trifle over 7 volts. We had to short-circuit the current, and we put in a wire from one side to the other, around the union, to connect those pipes in every instance. That is why I asked if it happened on a line of track. We never had any trouble at that time from electrolysis. I do not know how it is at the present time.

Mr. Lamson—I move a vote of thanks to the West End Railroad Company for the interest they have taken and shown by allowing Mr. Addicks to bring a paper here from the Company's Engineer. (Carried.) I would further move a vote of thanks to Mr. Addicks for the attention he has given to the subject and for his trouble in bringing these samples here. I also move that the Committee be continued for another year. (Carried.)

Mr. S. J. Fowler read his paper entitled,

SOME CARD CATALOGUES IN USE FOR RECORD OF THE OUTSIDE WORK OF A GAS COMPANY.

The managers of gas companies have developed such a philanthropic brotherly spirit, that when one of us finds a way of lightening his own labor, or that of those in his employ, the first impulse is to impart the knowledge of the improvement to fellow managers through the medium of our Associations. Many of you have the card catalogue already in use for certain purposes. I propose to show how I employ it for the advantage of the engineer in charge.

These card catalogues, at first used for library purposes, have proved themselves so convenient that they are now in use for many other purposes. They consist of cards of suitable size placed on edge and arranged in alphabetical or numerical order so that each card may be readily found and the contents read. Most of you are, of course, perfectly conversant with their form and use so that further description may be spared.

Those of us who have not the advantage of always having at command the services of a trained civil engineer probably often find ourselves in doubt as to the exact position of mains, especially of those laid

some years ago by the man who, not being a ready writer, kept his records in his head and who, having a phenomenal memory, could always locate a main when it became necessary. But that kind of man seems to have passed away, at least the original one has, and his phenomenal memory can no longer assist us, so that to-day in locating a main we are restricted to the records of the company. Any error found from time to time throws doubt on all the measurements given, so that it becomes the duty of the Manager to test all the figures.

With this end in view I have prepared the card now shown to you (see diagram 1), which is filled out every time we dig a hole in the street and expose a gas main to view. The information concerning the mains

Diagram 1.

MAINS. *SERVICES.*
..... *Street.*
New. *Repairs.*
Size of Pipe.....
Length of Line.....
Fittings. *T's*.....
.....
.....
.....
.....
Location of *Line of Pipe*.....
End of Pipe.....
Drips .....
High Point.....
Low Point.....
Material Used.....
.....
Depth of Pipe.....
Customer.....
Cause of Repairs.....
Time Consumed.....
Work Begun.....
Work Ended.....
Remarks.....

Date.....
Signed.....

Diagram 2.

.....Washington.....*Street*
Date.....June 15.... *Order No*...1,864 .
Customer ....Jackson & French.....
MAINS. (Canceled.) *SERVICES.*
..6..*New.* *Repairs.*..(Canceled.)
Size of Main....3 inch.....
Length of Line.....
Fittings. *T's*.....
.....
.....
.....
Location of *Line of Main*, 14 ft. south, etc.
End of Main .....
Drips .....
High Point.....
Low Point .....
Depth of Main....3 feet.....
Material Used..35 ft. of 1¼ inch pipe, (etc.)

Cause of Repairs (Canceled.) .....
Time Consumed....12 men 1 day.....
Work Begun....June 13 .....
Work Ended.....June 15.....
Remarks.....

Signed..L. C. Stevens.....

is compared with the record books and the records amplified, if necessary or desirable, or, in case of any disagreement, amended to correspond with the cards. It is a matter of only a few moments' work to make the alterations. The cards are then filed according to the name of the street, so that to-day our catalogue gives us the exact description and location of every main which we have seen since this plan was instituted. It will be seen that, though the catalogue is useful to us chiefly as a reference concerning mains, the cards may contain much more information; for, as stated before, a card is returned every time we expose a main to view, whether it be to lay a new one or repair an old one, lay a service or cut one off, or cut off a lamp post. We rarely put on a lamp post now.

It will be seen that a large number of items are given on the card, but as the card is used for all main work, as well as for all service work, we cannot see that any of the items are superfluous.

Our first line to fill up is the return of the street on which the work is done; then the date and the number of the order given at the office for the work. Then, if it be a service, either old or new, on which the work is to be done, the name of the customer is inserted. Next comes a description of the work done. We are either laying new mains or repairing old ones, laying new services or repairing (perhaps renewing) old ones. By simply drawing a line through the necessary words on the card we have an account of the nature of the work done. Thus, if a service is to be relaid, we draw a line through the words "Mains" and "New; so that the words remaining are "Services" and "Repairs." The other items on the card will be readily understood, such as "locations," "material used" and "cause of repairs." The cost of the work may be readily computed from the "time consumed," where we always insert an item telling the number of men. In our own case it is very convenient to have these cards to know the date on which any consumer's work was done, as we do not carry an indexed ledger account of service charges, and we can refer to these cards instead of looking up the order or its corresponding charge on the blotter. I give an instance of a card filled out taken at random from our files. (See diagram 2.)

We have had these cards in use now for a little over two years, during which time we have become more and more satisfied with them.

I confess that the size of the sheet is some objection, and it has been proposed to use two cards—one for service and one for mains—but I have not acceded to that proposition, because of the undesirability of having too many blank forms, and because, as Engineer, I desire to have all records of street work kept together.

Men of trained minds readily see the importance of keeping locations and descriptions with the greatest exactness—some of us have probably had difficulty in impressing that importance on the minds of the men who have immediate charge of street work—but in our case no one is more convinced of the desirability of filling out these cards in the most exact manner than are the men who have our street work to do. There is consequently no opposition to the system, but, on the contrary, willing co-operation. Often, when the work is somewhat extensive, the whole back of the card is covered with the locations of various fittings, etc., to which, of course, reference is made by writing "over" on the face of the card.

We also use the card catalogue system in keeping track of our meters. Orders come into our office to take down or to set meters, which orders are entered in the proper book and a corresponding card is given to the meter men. This card is returned to the office filled out, as circumstances require, and is then filed according to the meter number of the maker, for we do not make use of a Company number. We might be obliged to do so if we used meters of many makes, but as we practically use those of one manufacturer, the numbers do not conflict. Indeed, the chances of numbers conflicting are very small at any rate. There is practically no difficulty at all in keeping our catalogue in order while using the maker's number. The numbers may run from the hundreds up to a half million; by filing them in order we can always find the meter required, and, for ease of research, we insert larger cards, once in a while on which is a number, at which the cards are divided, so that we know that smaller numbers are in front of the large card and large ones behind it.

The cards we use are of four kinds—a "set" card, a "take down" card, a "test" card, and a "take state" card, as appended:

"Set" Card.

Set Meter .....*Lt.* *No*..... *Index* .....
For.....
.....*Street*
Work done by.....
Springfield.....189....

"Take Down" Card.

Take down Meter .....*Lt.* *No*..... *Index*.....
For.....
.....*Street*
Work done by.....
Springfield.....189....

"Test" Card.

Test Meter .....*Lt.* *No*..... *Index*.....| *F.* | *S.* | .....
Workman..... *Date*.....
Defects.....
Disposal.....
Repairs.....

"Take State" Card.

Take state Meter .....*Lt.* *No*..... *Index*.....
For.....
.....*Street*
Work done by.....
Springfield.....189....

The "take state" cards we do not file in our card catalogue, as that is rather a matter of detail for the bookkeeper.

When we have an order to take a meter down the proper card is given and returned, and filed. The meter is then tested at our works by our workmen; a record of that test is made and returned on the proper card, on which are also noted the repairs made, if we repair the meter ourselves. In case the meter be sent to the manufacturer, that fact is reported on the card, and when the returns from the maker are received his report is noted on the same card. Should the meter be found to be correct, it is set again and the proper card is filed. Thus, if Brown vacates his house we remove his meter and the card is filled out:

Take down Meter ....3....*Lt.* *No*....162,731..... *Index*....573.....
For.....Brown.....
.....Tenth.....*Street*
Work done by.....Jones.....
Springfield.....April 1....1894.

The meter is taken to the works and we receive the test card :

Test Meter ....3....*Lt.* *No.*....162,731.... *Index*...573....| *F.* | *S.* 15 |
Workman.....Smith..... *Date*....April 2, 1894.....
Defects.....Leak in diaphragm.....
Disposal .....Sent to maker.....
Repairs.....

In course of time we receive the meter back from the manufacturer, and, on going over his bill, find what his repairs amounted to, each item is entered under the appropriate head on the card, and which can be readily taken from the file. The card as returned to the file reads :

Test Meter ....3....*Lt.* *No.*....162,731.... *Index*.. 573....| *F.* | *S.* 15 |
Workman.....Smith..... *Date*... April 2, 1894.....
Defects.....Leak in diaphragm.....
Disposal.....Sent to maker.....
Repairs.....Two new diaphragms.....

We do not make a record of the State Inspector's tests of meters received from the factory, believing that to be unnecessary trouble, as, of course, we never set any meters which do not bear the official seal; but the meter having been returned from the factory and officially tested, is set again and the proper card is filed :

Set Meter .....3....*Lt.* *No.* ...162,731..... *Index*....000 .....
For..... Robinson .....
.....Twelfth.....*Street*
Work done by.....Jones.....
Springfield.....June 1....1894.

In this way we have a complete and accessible record of the course of each and every meter. In our own case the record is kept with practically no trouble at all. The cards as described have been long in use, with the exception of the "test" cards. Our meter men are accustomed to filling them out when an order is completed, and the only thing necessary to make them available for record purposes was a case of drawers of proper size.

Of the advantage of a good record of meters it is unnecessary for me to speak, for every manager has often felt it. The advantage of a record kept in this way is its ease and cheapness. It is not necessary to do any clerical labor at our office beyond filling out cards according to the advices of the meter manufacturer, nor is it necessary to use Company meter numbers, as, even if the manufacturers' numbers did conflict with one another, the name of the manufacturer could easily be entered on the cards. As I said before, in our own case the card catalogue costs us neither trouble nor expense beyond the charge for the case of drawers.

Our third catalogue is a record of the various complaints we receive. From this we get a knowledge of the conditions under which the customers use gas.

The card is of the same size as our meter cards, and is intended to be filed according to streets and numbers.

Street..... *No*..... *Date*.....
From.....
Complaint.....
Service. *Meter.* *House Pipes.* *Burners.* *Stoves.*
Report.....
.....
Signed .....

We have, first, the street, then the street number, then the date, next, the name of the customer, and then the customer's statement of the trouble.

Following that is our account of what was found and the means used to remove the difficulty.

We draw a line through one of the five items given, viz.: Service, meter, house pipes, burners, stove, to show where the trouble was, and then report the work which was done. We thus have a record of the number of complaints received from each customer; also, of the number of complaints received from each street, and, therefore, though indirectly, of the number of complaints in any quarter of the city. I say indirectly because, since the cards are filed according to the names of the streets, complaints from customers residing or doing business in close proximity to one another would not be found together in the catalogue unless those customers happened to be supplied from the same street main. If one lives or does business around the corner from the other it is possible enough that the two complaints would be found at the extreme ends of the catalogue. However, the close knowledge of the topography of the city which our business necessitates makes it an easy matter to make any combinations and ascertain whether a whole quarter of the city may be simultaneously affected.

This third catalogue we have had in use but a short time, so that I am not able to give a statement of the result of its practical working. Some of my fellow engineers have, I know, similar methods of keeping track of complaints and will undoubtedly give us the result of their experience.

In conclusion I would say that I have not tried to give a description of the application of the card catalogue principle to the entire business, but have simply described those which are now in use in our office for outside work. We find the plan a good one, and, if my paper proves of assistance to my fellow managers, I shall be very glad that I have brought up the subject.

Our blanks are, of course, not the best possible for every place. They would be too cumbersome for small companies and not sufficiently itemized for very large ones, but that is a mere matter of detail. As a matter of record keeping there is a place for the card catalogue.

Discussion.

The President—You have heard an interesting and to most of us a novel paper on the use of the card catalogue system in our business. I am afraid it will strike so many of you as novel that we cannot go into a discussion of it, and yet there may be some questions that some of you may want to ask Mr. Fowler. Has Mr. Addicks any suggestion in this line?

Mr. Addicks—A number of things I noticed in Mr. Fowler's method I would like very much to copy if I had not already approached the subject from a different standpoint, particularly in regard to the sizes. I think his methods are certainly excellent. I would not advise him to increase the number of his cards, nor would I advise him to reduce their size. As he has told you, the backs of the cards are frequently covered with very important details, and the shape of the card certainly assists the foreman in placing a line of main intelligently, if the job is done as described on the front. I also notice that he has utilized the standard size of card used by card catalogues, so that there is none of the expense connected with special paper or small orders, and I suppose he can order his card catalogues from standard sizes. I also find it is wholly unnecessary to have any company number on a meter. The Dorchester Company is the only one I am familiar with doing that, and I think it is entirely unnecessary. The maker's number and the initial are all that is necessary. We have several kinds of meters and yet have no difficulty. I wish also to express my appreciation of the plan of fixing complaints by street location. I should say that was an extremely valuable thing. It will indicate a local trouble. The engineer cannot be present all the time in his office, and does not know of these complaints, but by filing them away in this way he can look them over at any time. The only thing we do in that direction is in the case of the stoppage of the flow of gas in services. If it occurs twice in one year, we relay that service the following year. Mr. Fowler has asked me to bring certain plans that we use, and I will take this matter up, and in order to show how the thing is approached on two different lines I have brought these samples with me. *This* is the size of report which is our standard size. This started entirely accidentally. The old Boston Company had a number of pigeon-holes for the filing of papers of about that size—it so happens that it is the postal card size—so we took a sheet of that size, which is why it had to assume this particular size. This particular blank which I have here is the foreman's report. I will read what it says :

Foreman's Daily Report, Feb. 11, 1895.
At 219 Court street, from 2 P.M. to 4 P.M.
Looking for leak.

Then follows information with regard to the leak. This is signed :

Peter Smith, Foreman. Badge 10.

Every foreman has a badge. If he is a service foreman, he has badge A, B, C, D. If he is a main foreman, he has badge No. 1, 2, 3, 4. On the back of the card there is a charge of the number of hours each man spent on the work. That is turned in to the foreman to charge up. In the case of a leak, I will read what a card says :

Gas Leak. BOSTON, Sunday, Nov. 25, 1894.
Referred to Main Department, 9 A.M.
Kneeland street, 26 feet west of east side of Federal.
Given out at 9 A.M.
Reported by P. Smith, as leak in clamps.
Given out to Gang No. 10—P. Smith.
Trouble : Leak in 12-inch clamps.
Found by Gang No. 10—Smith.
Repaired by Gang No. 8—Courtney.

You will observe that it states who it is given out to, who it was found by, and who repaired it. Very frequently three different names appear there.

Found at 9:20 A.M.
Finished at 6 P.M.
The main was 3 feet deep; 12 inches in diameter.
Repaired by reclamping.

Then on the back is shown the length of time spent by each man in doing the work and the rate of charge and cost:

Hours.	Name.	Rate.	Cost.
10	Courtney	22½	$2.25
10	Donohue	20	2.00
10	P. Doherty	17½	1.75

These are all special cases. In the Boston Company in particular we have to have two different gangs of men for the services and mains. All this information in regard to leaks is filed in the card catalogue according to streets and number. You can, by referring to that, find how many leaks there have been on a certain line of main. In regard to services, I will say that a service order is made out for every case, and it is of the same size and form:

Service Order No. 894.
Street, No. 10, Beacon.
Received by Service Department, Sept. 6.
Service run, Sept. 7.
Page Service Book, 124.

Then on the back of the report appears this data:

Service, 1½ inch. Main to end, 15 feet.
Stock used, 2 street ells, 2 couplings. Size, 12-inch main.
1½ inches tapping. 2 feet 9 inches deep.
Main in good condition.
By Gang.....No. 5.
No. of men.....3. No. of hours.....6½.
Cost.....$5.06.

Here is our meter blank:

Date of order, July 19, 1893.
Name, "Fish Market Association."
Street, 61 T Wharf.
3 Light. 23788.
Reading, 00000.
Removed.
Badge No., 169,632.

(The meter was reported as correct. It was simply a meter ordered removed for some purpose. Probably no defect in the meter.)

Aug. 4....Repaired by McDonald....No. 14....Repairs.
Aug. 7....Inspected by State....Badge No. 1150.
Found correct.
Aug. 17....Set at 59, Chambers street, by Harrington.

I imagine that Mr. Fowler has had no difficulty in making these meter records conform with the meter. The Treasurer of the Company devised a method of doing this which has been found effective. We have had made by the Denison Tag Company a number of envelopes. The flap of the envelope, which is turned up, has an eyelet in it, through which a piece of string is passed forming a loop. When a new meter is received the information regarding it is put on one of these cards and put in the envelope, the loop is slipped over the meter, and there it hangs. Of course, during that time there is no record of the meter except by going and looking at the meter in the shop. When it is set, the jobber takes it out and returns it to its place in the catalogue. Now, suppose two years pass and that meter is removed, then another slip is made out for that meter, showing where it is taken from, and it goes back to the shop. The card states what the test is, what repairs were made and who repaired it. Then it hangs on the meter until it goes out again. Thus it appears on the face of that just where it came from and where it went. That goes to the card catalogues. Now, what is the value of that? Suppose that meter No. 324,472, Tuft, is found in an alley. Where will you find where that meter is? Go to the card catalogue, and you will find it. Then, referring to your ledger, you get the information in a few minutes. The service orders are filed in a similar manner. A special examination is made of every service, which is filed alongside of the service orders. Take a case:

Special Examination.

Date: Boston, Sept. 20, 1892.
Street No.: 33 North.
Occupant: Vaupel.
Owner: P. J. Riggio.
Business: Market.
Service: 1-inch. Rusty.
Pipe to meter: ¼-inch. Good.
Meter: 10-light. Good.
Riser: ¼. Good.
Governor: Yes.
Condition of service: Rusty.
Location of service: 8 feet from left hand wall.
Supplies: Meter for upper floor.
Is electric light used? Partial.

[Over.]

Services very rusty.
Referred to Service Department.
Relaid Sept. 29, 1892, with 1¼-inch service, by O'Hara.

This shows that special examination, and is for all inside leaks of services. I have had only one in two years. Now, as to the use. I will tell you of an occurrence not over a year ago. There was a very bad leak in a street in which are several mains; three of them were cut off, and so did not know where the leak was. They discovered where it was. They turned on the gas on two of the mains—the third one being a main upon which there were supposed to be no services, the gas was left turned off. That happened on Friday afternoon, at 3 o'clock. Next day came a report to the jobbing department that a certain party has no gas. The jobber goes around, takes out a plug, gets a good pressure of gas for a moment, and then the gas disappears. He pours alcohol "into the opening" and goes away. Hardly reaches the office when the telephone message is heard: "We have no gas." Goes back; opens the plug again; the pressure of the gas is good for a second. He doesn't understand it. Pours in hot water. Discusses the matter with the main department. Finds that that service is only 4 feet long. That main is sealed up. No; it can't be possible. What does the main department do? It is a newly paved street. They apply for a permit. There is a difficulty of getting the permit. Foreman comes to me and complains of the difficulty in getting a permit. I said, "Where does that service come from?" "It is from this 6-inch main." "Are you sure?" "Yes." "Go to the card catalogue and see what you can find." He goes to the card catalogue and finds that that service is off of the 10-inch main, from which the gas is shut off.

The President—Is there any other gentleman in the room who has had a similar, or a different method of keeping books which he believes in, or thinks is better than Mr. Fowler's?

Mr. A. W. Tarbell—This subject is very interesting to me, especially in the matter of the locations of mains and services. I have used a system for many years past which has proved very satisfactory to me. It is in the shape of an index book. Perhaps it would be of more value to a smaller company, who did not wish to be troubled caring for a large number of cards in a card catalogue. I take an ordinary memorandum book of convenient size, ruled across, and indexed right through the book, allowing as many pages or leaves for each letter as may be necessary to accommodate the names of the different streets of the town, which may begin with that letter of the alphabet. Then, at the head of the page, is placed the name of a street—for instance, under A, I put "Acorn street;" underneath that, the size of the main, "10 inches, through the street," or "10 inches, from A to B streets," and "6 inches from B to C streets;" and whether the main is of cast or wrought iron. Then I state the side of the street upon which the main is laid, whether the north, east, south or west; and then the distance out from the street line or curb. Of course, in laying a new main, this distance should be the same throughout the street if possible. Then, beneath that I put any items of interest pertaining to the main in that street, as valves, dips, angles, etc. As a case in point, showing the value of such a book as that, I may state that in a small company, where the street mains were overhauled by me some years ago, and the street leakage reduced from 33 to 7 per cent., it was found necessary to dig 150 or more holes. There were no existing records, and a book of this kind was started and measurements taken at every excavation made. At the end of the work we found there was a very accurate description of the whole main system, there being about 5 miles of it. Then, from that data, as well as from measurements taken of valves and drips, it was possible to make out a complete map of the street main system of that town. Another case of using the same system proved of equal value. Some 18 years ago I started one of these books in a similar case, and after a few years of digging for leaks it was possible in that place also to make from the data and records contained in one book a complete map of the street main system, there being about 5 miles of mains in this case. I think if such a book or a duplicate were made of a size to be carried in the pocket of the foreman, it would be specially valuable to him in "barring" for leaks without the necessity of referring to the card catalogue in the office. I can conceive of cases where this book might be used to advantage as a book of original entry and a basis for a card catalogue. The same system may be in use in other places, but I have never happened to see any, except where I introduced it myself.

On motion of Mr. Lamson, the thanks of the Association were voted to Mr. Fowler for his paper.

Report of Committee on President's Address.

Mr. Lamson—The Committee to whom was referred the President's Address recommends a careful perusal of the same by every member of

the Association, and directs special attention to the appropriateness of discussions on the commercial side of the gas interest.

On motion of Mr. Neal, the report was accepted.

[To be Concluded.]

[OFFICIAL REPORT.—REVISED BY THE SECRETARY.]

PROCEEDINGS SECOND ANNUAL MEETING OF THE MICHIGAN GAS ASSOCIATION.

The Second Annual Meeting of the Michigan Gas Association was held in the parlors of the Hotel Vincent, Saginaw, Wednesday, February 20, 1895.

MORNING SESSION.

The meeting was called to order at 10 o'clock, by the President, Mr. Sedgwick Dean, of Owosso.

ROLL CALL.

The following members were in attendance:

Active.

Calhoun, Robt., Bay City.	Hyde, Henry H., Saginaw.
Calkins, J. M., Big Rapids.	Morgans, W. H., Pontiac.
Dean, Sedgwick, Owosso.	Morton, J. S., Benton Harbor.
Denham, G. L., Flint.	Neuendorf, Chas., Saginaw, West.
Douglas, Henry W., Ann Arbor.	Raynor, C. H., Adrian.
Eaton, W. M., Jackson.	Tippy, B. O., Grand Rapids.
Edick, C. M., Benton Harbor.	Walbridge, H. D., Grand Rapids.
Gallagher, E. F., Ionia.	Walker, Joseph, Port Huron.

Associate.

Bonney, W. P., Erie, Pa. Harper, H. D., Chicago, Ills.
George E. Harris, Chicago, Ills.

The reading of the minutes of the last meeting was omitted.

REPORT OF THE EXECUTIVE COMMITTEE.

The Secretary submitted the following report of the Executive Committee:

February 19, 1895.

To the Members of the Michigan Gas Association: Gentlemen—Your Executive Committee hereby reports that the following papers have been approved to be read at this meeting:

"Opposition Gas Companies," by Mr. Joseph Walker, Port Huron; "Federation," by Mr. C. H. Raynor, Adrian; "Whose Make of Lighting Fixtures Shall We Recommend?" by Mr. W. M. Eaton, Jackson; "The Heating Effect of Artificial Lights," by Mr. Henry W. Douglas, Ann Arbor.

The following have been appointed a committee to name officers for the ensuing year: Robert Calhoun, W. H. Morgans and Joseph Walker.

This Committee recommends that the following gentlemen be transferred from the list of Honorary Members to that of Associate Members: W. P. Bonney, Geo. Osius, Edw. Woodberry, and John D. McIlhenny. And also that the name of Alten S. Miller be transferred from the list of Associate Members to that of Active Members.

This Committee has approved the following applications for membership and submits them to the Association with the recommendation that they receive favorable action.

Active Members.

Jos. C. Sterling, Secretary and Superintendent, Monroe (Mich.) Gas Light Company.

Russel B. Owen, Manager Hillsdale (Mich.) Gas Company.

M. J. Bostwick, Superintendent Ypsilanti (Mich.) Gas Company.

L. E. Walker, Secretary and Superintendent Lansing (Mich.) Gas Light Company.

J. J. Knight, Manager, Kalamazoo (Mich.) Gas Light Company.

Associate Members.

D. J. Collins, Western Sales Agent, United Gas Improvement Company, Philadelphia, Pa.

George D. Roper, President Eclipse Gas Stove Co., Rockford, Ills.

S. S. Stratton, Agent Metric Metal Company, Erie, Pa.

A. D. Cressler, General Manager Kerr Murray Manufacturing Company, Fort Wayne, Ind.

John Stout, Agent American Meter Company, Chicago, Ills.

This Committee recommends (1) that the Secretary be instructed to furnish free of charge to the gas JOURNALS a synopsis of the proceedings of the meeting; and (2) that this policy be the fixed policy of the Association for the future.

On motion the report of the Executive Committee was adopted.

REPORT OF THE SECRETARY AND TREASURER.

To the Members of the Michigan Gas Association—Gentlemen: At the present time there are the following members of this Association:

Honorary members	5
Active members	32
Associate members	9
Total	46

Financial Report.

Receipts—		
Received from initiation fees and dues		$35 00
Expenditures—		
Stenographic work on reports of 1894	$3 00	
Printing and stationery	9 00	
Telegrams	1 04	
Total		$13 04
Cash on hand		$21 96

Very respectfully submitted, HENRY H. HYDE, Sec. and Treas.

It was moved and carried that the report of the Secretary and Treasurer be accepted.

REPORT OF COMMITTEE ON BADGE.

To the Members of the Michigan Gas Association—Gentlemen: Your Committee on Badge, to whom was referred the duty of selecting a design for a suitable badge for this Association, reports that it has obtained a number of designs, and submits for your approval the one attached, which is the representation of the face of a station meter.

Very respectfully submitted, H. H. HYDE, Chairman,
W. M. EATON,
C. H. RAYNOR.

The President appointed Mr. H. D. Walbridge, Mr. W. M. Eaton and Mr. E. F. Gallagher, a committee for the selection of the place for holding the next meeting.

[To be Continued.]

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, Feb. 10, 1895.

Crude Water Gas and Incandescent Lighting.—Acetylene.—The Cold.—Mr. Boverton Redwood's Hydrogen Test for the Presence of Inflammable Gases.

Some experiments that have recently been undertaken in Vienna, in the direction of using uncarbureted water gas for street lighting by the medium of the Welsbach incandescent burner, present results that will prove rather striking to those who follow thoughtfully the history of our industry. The whole system of apparatus used, from the generator to the burner, appears to have been specially designed under skilled superintendence, and apart from any question of commercial value, the experiment seems to have been carried out in a thorough and successful manner that reflects great credit upon those responsible for it. One special feature connected with the preparation of the gas is its purification by treatment with sulphuric acid. By this means it is claimed that "iron carbonyl," a material that is apt to form deposits at the burner, or on the mantle, is removed. On this point there is a difference of opinion, as some say that the deposit is due, not so much to matters carried from the generator, as to rust or sulphur impurities that are present in the distributing mains, and are carried forward mechanically with the current. The gas is caused to acquire a sensible characteristic odor by the use of a hydrocarbon the value of which is kept secret. It is open to question whether this substance is added in sufficient quantity to affect the non-luminous character of the gas. It was found that the shape and size of the mantle, chimney and accessories used had an important influence on the duty obtained, and the best results appear to be secured with a moderate consumption and pressure—say, 6 to 8 cubic feet per hour, and 7-10ths to 9-10ths. With a glass chimney, a duty as high as 14 candles per cubic foot of gas used has been recorded, but with the tall chimney generally adopted for outside lighting, this falls to about 10 candles. Compared with ordinary coal gas at 4s. 6d. per 1,000 cubic feet, consumed in flat flame burners, the water gas is said to afford seven times the light at two-thirds the cost; but here we may remark on the absence of a test of the coal gas with the incandescent burners. To quote one practical test, it was found that in a certain street, bearing the not inappropriate title of "Badgasse," four ordinary burners gave a united effect of 52 candles. They were replaced by five water gas in

candescent burners, which furnished a total of 439 candles at a cost of 0.9d. The cost in the first case was 1.08d., so there was a saving of 0.18d. But this saving would in practice be more than counterbalanced by the depreciation that follows the use of the mantles, which is said to range from 20 to 30 per cent. It also appears from the figure above given that the flat flame burners were only using 3 cubic feet per hour, and therefore were not under favorable conditions. Still, after every reasonable allowance, it would appear that the water gas, the cost of which was said to be 1s. 5d. per 1,000 cubic feet, was cheaper, light for light, than the coal gas at 4s. 6d.

Mr. Willson's process for the manufacture of calcium carbide, which has already been described in your columns, has found an able advocate here in the person of Professor Vivian B. Lewes, who recently gave an enthusiastic account of it in the course of a lecture on "The Commercial Synthesis of Hydrocarbons," delivered before the members of the Society of Arts. This gentleman appears to have formed very favorable anticipations in regard to its future. He has been examining the illuminating value, and obtained much higher results than those indicated in the article above named. When burned in a pure form in small flat flame burners, Professor Lewes obtained a duty of 48 candles per cubic foot of acetylene consumed; but so far as he has gone, the enrichment value, when added to water gas in small quantity, is *nil*, and when added to coal gas, only about two-thirds of the result just indicated. The enrichment value is, of course, the most important feature to gas companies, and it is remarkable that acetylene should furnish an exception to other rich gases, which are usually found to give much better value when properly diluted than when consumed in the pure state. Reasoning upon data similar to that which you have published, Prof. Lewes arrives at a cost of 6s. 4½d. per 1,000 cubic feet for the new compound, and makes comparisons on such lines with ordinary coal gas, oil gas, etc., of course very much to the advantage of the former. But it is scarcely necessary to mention that such a price is entirely a delusion so far as any idea of the cost of acetylene in any English town is concerned. It includes only the price of materials, labor and a very low estimate for electrical power, the latter being obtained under specially favorable circumstances. But there will be the wear and tear of the grinding machinery to reckon with, and also some profit for the manufacturers, royalty for the patentees, etc. Calcium carbide, being decomposed by the mere addition of water, with the evolution of large quantities of explosive and poisonous gas, is a dangerous material for transit in a damp climate. Even if packed in watertight metal drums, the railway companies would probably refuse to carry it. If used in any considerable quantity it must be produced on the spot, and the cost for electrical power in most English localities, even if the spare time of an electrical lighting plant could be utilized, would greatly exceed the American estimates. The electric company would expect to get some profit out of the operation after paying for coal, labor and wear and tear. Even crediting acetylene with all that is claimed for it, there is no superiority to naphthaline, benzine and other cheap enrichers. Acetylene has no effect on naphthaline deposits, is soluble in water, is said to be as poisonous as carbonic oxide, and is capable under certain circumstances of forming an explosive compound with copper. It has been instanced as one of the deleterious and hurtful substances that are evolved by coal gas when not properly burned. So that while not denying certain special uses for calcium carbide, such as railway carriage lighting, buoys and lightships, etc., I am not highly impressed with its alleged superiority as compared with existing processes for the manufacture of illuminating gas. From a scientific and chemical point of view the process is extremely interesting, not only on its own account, but as opening up a hitherto unexplorable region. It will throw light on many subjects, such as the formation of natural hydrocarbons, whether solid, liquid or gaseous, and probably inaugurate a new branch of applied chemical industry.

Last month I remarked, upon commencement with the New Year, of a period of winter weather. This has continued throughout the whole of January, and up to the date of writing shows no signs of a change. Indeed it is increasing in severity. Within the last few days a greater degree of cold has been reached than has obtained for many years. Temperatures of zero and under have been registered in several parts of the country. Many of the thermometers in popular use stop at 15°, and the consequence is that the mercury has retired completely into the bulb, a fact which creates some amusement. This unusual cold is looked upon from several points of view. The poor and needy tell us of their sufferings, the wealthy talk about their sleighs and skating. The scientist reports the record temperatures, and the society gossiper prates about the individual of cast iron constitution, who refuses to be baulked of his matutinal dip by the cold, and prepares for that enjoyable and health sustaining luxury by a vigorous attack upon the ice with a sledge hammer. But in these columns we regard it as a means of increasing the sale of gas and of coke. In these respects it has been very favorable. The demand for gas is augmented, and that at a period sufficiently remote from the shortest day to enable it to be comfortably dealt with. We have additional proof of the extent to which gas is depended upon as a means of supplying artificial heat. In my own experience a hard frost means at least a 10 per cent. increase. Coke is selling out readily, and many yards are quite cleared, so we shall again be able to contemplate the summer accumulations with equanimity. And this has been obtained without any endeavor to force the price of coal. The recent mild weather has caused an accumulation of stocks, which the merchants are only too pleased to reduce before the spring comes on. Most gas undertakings, warned by the experiences of the last few years, took care to begin the winter with good stocks, and have now good reason to congratulate themselves on the results of such foresight.

The recent explosions in electrical culverts have had the effect of directing attention to Mr. Boverton Redwood's apparatus for detecting the presence of inflammable or explosive gases, which is claimed to give reliable evidence of the presence of so small a proportion as ½ per cent. of coal gas. The principle is very simple. A small hydrogen flame is contained in a cylinder fitted with a glass pane for observation. This is easily supplied from a cylinder of compressed gas. A sample of the suspected air is collected in a combined reservoir and force pump, somewhat of a similar character to an ordinary service cleanser. The nozzle attached to this pump can readily be introduced into a sewer, or other inaccessible locality. The sample having been taken, can be conveyed any reasonable distance. It is supplied to the base of the hydrogen burner, so as to form the atmosphere in which the hydrogen is burnt. Suitable means are taken to prevent any risk of firing back. The flame is then inspected in a dark room, which is easily managed by a light frame carrying a black cloth of sufficient size to admit the head of the observer. If the sample is free from inflammable gas, the hydrogen flame remains clear. But if otherwise, a kind of flame cap of a bluish gray color forms on the hydrogen flame. Assuming the proportion of inflammable gas to increase, the cap first becomes better defined, and then increases in size. So that with a little experience the apparatus can be used as a quantitative test within the limits of one-half up to 3 or 4 per cent. of inflammable gas. By means of this apparatus it is possible to trace and locate leakages or escapes in gas pipes, and it is especially useful for gases that do not possess a characteristic or distinctive odor, such as crude water gases, or for gases that have been deodorized by passing through a few feet of soil. It is also well adapted for taking tests of the air in electric culverts. A few days' work, especially if a number of sample collectors were employed, would soon tell whether the system of gas supply is so leaky as some of the electric light people wish the public to believe. It would also solve the vexed question of whether gas escapes or leaks to any extent through the substance of a cast iron pipe, and whether there is any truth in the idea that considerable quantities of gas do escape in that manner, and that the deodorizing influence of the soil is responsible for the non-detection of the same. This is rather a question of the day, because some of our popular newspapers, always more anxious to catch the public fancy than to follow such old-fashioned principles as truth and justice, have waxed very eloquent over the iniquity of gas companies, who from motives of economy are supposed to lay pipes that are too thin to resist the pressure of the gas, and so near to the surface as to be readily attacked by frost or heavy traffic. It is also a question for gas engineers, who are not so much in touch with the "unaccounted for" problem as they would like to be.

Gas Works Normals in Berlin.

The *Gas World* notes that the following are the standard dimensions, etc., adhered to in Berlin, and known in Germany as the Berlin normals. The maximum production on a December day is taken as the basis:

Retorts.—Silesian coal, 250 cubic meters (8,833 cubic feet) per 24 hours: 15 per cent. reserve retorts, not to fall below 10 per cent. in case of repairs.

Condensers.—Minimum of 12 square meters per 1,000 cubic meters gas (3.8 square feet per 1,000 cubic feet) per 24 hours: in regularly running works 15 square meters (4¾ square feet); in Berlin, cylinders 130 cm. diameter (52 inches) by 880 cm. (352 inches) height, with 11 cooling tubes of 105 mm. (4.2 inch) diameter, the outer jacket with the connecting tube to the next cylinder gives nearly the same superficial area of cooling surface as the inner tubes give of water cooling surface.

Scrubber.—With wooden shelves: Minimum of 5 cubic feet per 1,000 cubic feet gas per day, and a regular normal size of 6 cubic feet per 1,000.

Exhauster.—One spare machine in each works as reserve.

Purifiers.—Four shelves with iron oxide: Normal, 260 cubic meters in 24 hours per square meter of purifier ground area in four purifier systems, all four purifiers being reckoned in (850 cubic feet per square foot); at an emergency in winter, with good fresh purifying material, up to 300 cubic meters (1,000 cubic feet per square foot ground area).

Pre-purifiers.—Four to six shelves with sawdust: One to each purifier, and of the same ground area with it.

Station Meter.—Maximum of 80 revolutions per hour: Calculate the greatest gas run per hour as about 10 per cent. higher than the average production per hour; according to an older rule the hourly run was taken as $\frac{1}{20}$ the day's make.

Gasholder.—Not less than 80 per cent. of the greatest day's make; but this is an uncomfortably low provision in Berlin.

Tubes.—From five ovens, each of nine retorts, diameter 315 mm. (12.6 inches). As the pipes meet, diameters of pipes go up to 36.6, 39.6 and 40 inches, for a speed of 3 meters (10 feet) per second. If the diameters be less the velocity must be kept down.

Transverse Connections between two mains of the same works, before and behind the apparatus groups, up to 12 feet per second velocity.

Mains.—With diameters 36.6 to 40 inches, reckoned that 1 inch pressure is lost per 2,500 to 3,000 meters (8,300 to 10,000 feet); and the greatest hourly run on the day of maximum supply in December is one-eighth the whole day's supply.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Mr. J. H. Cardall, Superintendent of the New Memphis (Tenn.) Gas Light Company, does not bother himself much about the significance which some people attribute to a "13" of any sort, for on the 13th of February he took unto himself a wife, in the gracious person of Miss Mary A. Burk. The best of good luck to them.

Mr. Henry W. Sage, Secretary of the Cincinnati (Ohio) Gas Light and Coke Company, acting under the instructions of the Directors of the Company, has issued the following notice to the stockholders: "You are hereby notified that as the Company assumes and will pay the tax upon its net profits, as required by the recent legislation of the United States Government, under the provisions of Section 28 stockholders will *not be required to list or pay income tax on dividends derived from investments in the stock* of the Company."

We regret to announce the death of Mr. John H. Schneider, Assistant Superintendent of the Schneider & Trenkamp Company, whose demise occurred on Friday, February 22d. Deceased was in his 24th year, was the son of Paul and Anna Schneider, and was a young man of great promise.

Mr. John S. Kaneen, Secretary of the San Rafael (Cal.) Cas and Electric Light Company, has notified the residents that hereafter the price of gas for illuminating purposes is to be $3 per 1,000 cubic feet; the rate for cooking, heating and power purposes to be $2 per 1,000 cubic feet. The Company will also replace its Heisler system of incandescent electric lighting supply with a more modern type of apparatus.

Mr. Percy E. Gerould has been appointed Superintendent of the Peru (Ind.) American Gas Company, to succeed Mr. A. J. Reinbold. The latter gentleman has accepted a position in the manufacturing department of the Elgin (Ills.) American Gas Company.

Superintendent Jenkins, of the Gas Light Company, of Columbus, Ga., reports that during the month of February the use of gas for purposes other than lighting amounted to 25 per cent. of the total output.

At the annual meeting of the Clinton (Mass.) Gas Light Company the following officers were elected: Directors, Eli Forbes, Henry N. Bigelow, John E. Thayer, Herbert Parker and John R. Foster; President, Eli Forbes; Treasurer, Clerk and General Manager, H. N. Bigelow; Superintendent of Works, Wm. H. Spaulding. A dividend of 1¼ per cent. was also declared.

The exclusive franchise under which the Kansas City (Mo.) Gas Light and Coke Company has been operating for the last 30 years, expired by limitation on the 20th of February. The ordinance recently passed by the Council making it unlawful to charge more than $1 per 1,000 cubic feet took effect on the 1st inst., and President Tiernan, of the upper branch of the Council, avers that the Board of Public Works will refuse to audit bills for gas at more than $1 per 1,000, according to the ordinance.

In the meantime the Kansas City Company claims that its charter is really perpetual, although it tacitly admits that the exclusive feature became inoperative on the 1st inst. To quote the opinion of Mr. Chas. E. Small, Attorney for the Company: "The word perpetual means perpetual, and that is just what we have. Admitting that the exclusive franchise expired February 20th, the Company nevertheless has the right to do business in Kansas City for a million of years, if it wants to, and it will continue to do business for a portion of that time. The officials of the city have brought on a fight which is antirely needless. At $1.60 per 1,000 we are not making over 8 per cent. profit, but we were inclined to give the city the benefit of a still further reduction, and to give the people gas at a lower figure, even if we did not make so much. But the city's advisers have compelled us to make a fight and rejected the proposition we were ready to make them for a reduction in the price of gas. If the expense of litigation is forced upon us, and if the city is going to fight us, we will not, because we can not, make any such reduction. No court in the country ever held or ever will hold that a corporation can be made to sell its products or do business at a loss or without making a reasonable profit. The Company is absolutely unable to sell gas at a reasonable profit at $1 per 1,000, and there is no use in trying to make it do so. The Supreme Court of the State has decided that our franchise to do business is perpetual, and we shall deal directly with the people if the city's advisers are not disposed to do the fair thing, but we will stand on all our rights in the premises."

The second payment, of 15 per cent. on the purchase price ($1,200,000) of the Grand Rapids (Mich.) Gas Light Company's properties was made on the 20th of February. The third payment is due on March 20th.

Mr. Gunn has introduced a resolution in the Connecticut Legislature extending the time for organization of the Milford Electric Light and Gas Company.

Mr. McCarthy has a bill in the Illinois Legislature which seeks to debar Gas Companies from demanding a cash deposit as security for the payment of gas bills.

The Burlington (Vt.) *News* says: "The Burlington Gas Light Company is getting into line for its new equipment this spring. The Company proposes to erect new buildings and move its entire plant to the plot, west of Pine street near the lake shore, in the south part of the city. It has already contracted with the Berlin Iron Bridge Company for the iron roofs of the new buildings, and with the United Gas Improvement Company for the apparatus. The new buildings will include a generator room, 30 feet by 38 feet, a purifying room, 30 feet by 40 feet, a boiler room, 15 feet by 27 feet, an engine room, 15 feet by 23 feet, an exhauster room, 10 feet by 12 feet, station meter and office rooms; also a coal shed, 26 feet by 46 feet. There will be two gasholders, 58 feet and 80 feet in diameter, respectively. A spur from the Central Vermont Railroad track will run into the coal shed, on an elevated platform, for the easy and cheap handling of coal. The improvements will cost the Company about $40,000."

The proprietors of the Excelsior Gas Company, of Benton Harbor, Mich., have under consideration the extending of their main system to the post village of St. Joseph, which place is 2 miles southwest of Benton Harbor. St. Joseph is a thriving settlement, much given to manufactures of baskets, packing boxes, fruit crates, sash and blinds, etc., and is quite a spot for the growing of small fruits. According to the census of 1890 it then had a population of 3,733.

The Connecticut Legislature has assented to the petition of the Waterbury Gas Light Company for permission to increase its capital from $250,000 to $390,000.

At the annual meeting of the Zanesville (O.) Gas Light Company the officers elected were: Directors, M. M. Granger, C. H. Abbott, Alexander Grant, Robert Fulton and Eugene Printz; President, M. M. Granger; Secretary, G. A. Allen; Treasurer, the Citizens National Bank; Superintendent, Eugene Printz.

The organization of a Gas Company to supply the district of Victoria, Tex., is reported. This place is the capital of a similarly-named county of Texas, and is on the east bank of the Guadelupe river at a point 100 miles east-southeast of San Antonio. It can also be reached by the

Gulf, Western Texas and Pacific Railroad. It has a population of 3,000, and is chiefly noted for its shipments of cattle.

THE annual meeting of the Providence (R. I.) Gas Company will be held to-day, in accordance with an amendment to its charter, passed by the General Assembly of Rhode Island in January last. Hitherto the annual meetings were held on the first Monday of September; hereafter they will be held on the first Monday of March.

AT the annual meeting of the Manitoba Gas and Electric Light Company, of Winnipeg, Manitoba, the officers elected were: President, H. E. Crawford; Vice-President, Secretary and Treasurer, Wm. Bathgate.

THE contract for the plant of the new Gas Company for Murphysboro, Ills., has been awarded to the Western Gas Construction Company, with the understanding that it is to be completed by June 1st, 1895. The cost of the work is put at $30,000.

THE New York and East River (L. I.) Gas Company has reduced its selling rate in Long Island City and vicinity to $1.50 per 1,000 cubic feet, the concession to date back to February 1st.

THE following well arranged table shows just what has been accomplished by Mr. J. R. Todd, in the matter of placing Welsbach lamps in the territory covered by the Dedham and Hyde Park Gas Light Company, Walnut Hill, Mass.—the figures are the records to Feb. 24th:

Stores in Place of				Public Buildings and Offices in Place of				Dwellings in Place of				Total Number in Place of		
Elec.	Oil.	Gas.	No. Lts.	Elec.	Oil.	Gas.	No. Lts.	Elec.	Oil.	Gas.	No. Lts.	Elec.	Oil.	Gas.
8	7	2	83	6	1	9	55	3	2	22	42	68	49	63

IN this column an "item" is made of an award by the Murphysboro (Ills.) Gas Company, of a contract for the construction of its works to the Western Gas Construction Company, and since that mention was written we received the following official statement about the award from Mr. Ernest F. Lloyd: "In your issue for February 25th we note the incorporation of a new Gas Company for Murphysboro, Ills., and in this connection we beg to advise you that we have closed a contract with them for a complete works, including one of our special settings of improved Lowe water gas apparatus, of 75,000 cubic feet capacity, 2 purifier boxes, a 4-ft. station meter, and a 30,000 cubic foot storage, together with all the connections complete; the works to be erected by us and delivered to the Company in complete running order. Work has been started and will be finished and the plant put in operation as soon as the Company can lay its street mains.—THE WESTERN GAS CONSTRUCTION COMPANY."

WE regret to report the death, at Grant's Pass, Oregon, on Feb. 22d, of James Wilson Cramer, oldest son of Mr. A. W. P. Cramer, of the Equitable Gas Light Company, of this city.

MR. MARTIN, of the New Mexico Legislature, is the sponsor for a measure before that body, which provides that "not more than one company furnishing electric lights and one company furnishing gas lights shall hereafter be authorized or permitted to be established or do business in any incorporated city, town or village in this Territory having a population of less than 12,000." It is stipulated, however, that gas companies covered by the section shall not be allowed to charge more than $3 per 1,000 cubic feet, nor shall electric companies charge more than 8 cents per candle power per month for lights furnished for all night, when furnished by lamps only; and when the consumer pays by meter such company may not charge for electric lights more than 25 cents for each 1,000 volts consumed. It is provided further that additional plants may be established where asked for by two-thirds of the qualified voters at special elections to be held on the petition of a majority of the householders of any incorporated city, town or village.

JUDGE START, of the Supreme Court, has handed down an opinion in the appeal taken from a decision of the Minneapolis District Court by the Minneapolis Gas Light Company, by which it was held liable for damages to residents on the flats below which its oil tanks are located, the tanks having leaked to the extent of permeating the soil and polluting the waters of the wells. The Supreme Court holds that every person who for his own profit maintains conditions on his own premises which are injurious to the premises of others is liable for all consequences, whether he exercises proper care or not. A syllabus of the opinion is: "The defendant, for its own use and profit, stored, upon its own land, large quantities of crude petroleum, which escaped therefrom and went on to the premises of the plaintiffs, creating thereon a nuisance. *Held*, following Cahill vs. Eastman, 18 Minn., 324, that the defendant is liable for the damage caused by such nuisance, without proof of any negligence on its part. *Held*, that in a case of a nuisance created upon premises occupied by plaintiffs as their homes, by the defendant, the damages are not limited to the diminution of the rental value of the premises during the continuance of the nuisance, but they may recover damages for any actual inconvenience and physical discomfort which materially impaired the comfortable and healthful enjoyment and occupancy of their homes, and for any actual injury to their health or property caused directly by the nuisance, without fault on their part. Evidence considered and held to sustain the verdict. *Held*, that the damages are not excessive. Order affirmed."

MR. LARRABEE, of Portland, Me., has introduced a bill in the Legislature of that State which seeks to "authorize all gas light companies which are authorized to furnish gas for lighting purposes to also furnish the same for heating purposes."

THE Berlin Iron Bridge Company, of East Berlin, Conn., has just completed, for the Hartford and West Hartford Horse Railway Company, a new truss bridge, 136 feet long, over the Farmington river, at Farmington, Conn.

MR. WILLIAM BALLARD, Superintendent of Public Lighting, Nashville, Tenn., in his report to the Board of Public Works, covering the operations of his department for the past year, says that the gas street lights (of which 430 are in use) gave good satisfaction. The total quantity of gas consumed was 5,424,786 cubic feet, and he recommends that more lamps be put in duty in certain sections of the city.

WE understand that Waukegan, Ills., is to have a gas works, and an application for a franchise for the right to operate the same is before the City Council. Messrs. E. G. Cowdery and A. E. Smith, of Milwaukee, Wis., and Mr. S. H. Sweet, of Chicago, are interested in the venture. It is said that $100,000 will be invested in the enterprise, and that it is proposed to sell gas at $1.40 per 1,000.

THE following are the proposals submitted for the public lighting, by means of arc lamps, of the city of Ogdensburgh, by Secretary Chapman, of the Ogdensburgh Gas Company: "*First.*—Proposition for six months, one year, and more than one year: We will furnish 100 or more arc lights, 22 nights per month, burning not less than six hours per night, at 25 cents each per night. *Second.*—Proposition for six months, one or more years: We will furnish 100 or more arc lights 22, nights per month, burning not less than eight hours per night, at 32 cents each per night. *Third.*—Proposition for one or more years: We will furnish 100 or more arc lights, 22 nights per month, burning not less than six hours per night, and four months of the year, at 25 cents each, per night. Four months, burning not less than eight hours per night, as above, at 32 cents each per night. And the remaining four months, as above, burning not less than 10 hours per night, at 37 cents each per night."

FROM the annual report of Mr. C. A. Ballou, Supt. of the Danville (Va.) City Gas Works, we learn that during the year ended Dec. 31, 1894, the total quantity of gas made was 20,302,200 cubic feet, which is thus accounted for: Ordinary consumers, 16,228,400 cubic feet; used in city buildings, 452,400 cubic feet; used on bridge, in street lamps and at gas works, 300,000 cubic feet; leakage, condensation, etc., 3,321,400 cubic feet. Continuing, Mr. Ballou says: "The average yield of gas per pound of coal was 4.66 cubic feet; the average candle power was 16.22; the weight of coal carbonized was 4,355,100 lbs. We used altogether Kanawha coal and no enricher. The increase in the output over that of the previous year was less than 7 per cent. The increase of the output in 1893 over that of 1892 was over 18½ per cent. It was supposed that the reduction in the price of gas in the early part of the year would encourage a larger increased consumption than in previous years. But taking into consideration the depressed condition of business and the financial stringency throughout this country, this result should not be wondered at, and is no serious cause for discouragement. On the other hand we have very much to encourage us. In March the price of gas was reduced from $1.25 to $1 per 1,000 cubic feet, net. It was with much hesitancy that your committee on light recommended this reduction of price. While they desired to furnish gas to the citizens at the lowest price practicable, yet they had fear that the receipts from the reduced price would not pay running expenses. The result has been that after paying all running expenses of the works and paying the cost of all new mains put in during the year, amounting to $2,913.25, there is a balance in favor of the department of $2,359.52."

THE AMERICAN GAS LIGHT JOURNAL

MONDAY, MARCH 4, 1895.

The Market for Gas Securities.

Consolidated was firm and higher during the week, the opening to-day (Friday) having been made at 133 bid, offered at 134. The regular quarterly dividend of 2 per cent. was declared February 25th. The books were closed March 1st, to be reopened the 15th. The stock is a purchase, and we have no doubt that higher figures will rule in it soon than any heretofore reported. Equitable and Mutual are on the rising scale, and Mutual, at 155, looks to be a purchase. Our predictions are based on the present outlook respecting gas rate legislation, which, in our belief, will not amount to anything this year. The Brooklyn situation shows no change, although nominal quotations are on the weaker side, mainly because of the fuss being made over Assemblyman Wray's bill, ostensibly to prevent the carrying out of the Brooklyn consolidation. The measure seems merely to be a tandem horse to help draw the Coffey rate bill to an easy resting place. Chicago gas is weaker, on the passage by the Council of an opposition gas charter; meanwhile Chicago is a purchase. Bay State gas is weak, and so is Baltimore Consolidated. Rochester preferred is 81 bid, and is cheap. All New Jersey shares are stronger, on the defeat of the Gruber gas rate bill.

Gas Stocks.

Quotations by Close & Nash, Brokers and Dealers in Gas Stocks.

35 WALL ST., NEW YORK CITY.

MARCH 4.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	133	134
Central	500,000	50	—	—
" Scrip	220,000	—	100	—
Equitable	4,000,000	100	180	182
" Bonds (6's)	1,000,000	—	107	—
" " (5's)	.....		111	—
Metropolitan, Bonds	658,000	—	108	112
Mutual	3,500,000	100	153	—
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern	.....	50	95	—
" Bonds	150,000	—	95	—
N. Y. & East River Gas				
Common	5,000,000	100	20	23
Preferred	2,000,000	.....	—	45
Bonds	3,500,000	100	80½	81½
Richmond Co., S. I.	348;650	50	50	—
" Bonds	100,000	—	—	—
Standard Gas Co—				
Common Stock	5,000,000	100	37	40
Preferred	5,000,000	100	89	91
Yonkers		50	112	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	122	—
Citizens	1,200,000	20	60	—
" S. F. Bonds	320,000	1000	—	101
Equity Gas Light Co.	2,000,000	100	—	—
Bonds	1,000,000	—	—	—
Fulton Municipal	3,000,000	100	175	—
" Bonds	300,000		103	—
Peoples	1,000,000	10	85	—
" Bonds (7's)	368,000	—	100	—
" " (4's)	94,000	—	98	100
Metropolitan	870,000	100	160	—
" Bonds (5's)	70,000	—	—	155
Nassau	1,000,000	25	200	—
" Otis	700,000	1000	99	100
Williamsburgh	1,000,000	50	190	—
" Bonds	1,000,000	—	107	110
Out of Town Gas Companies.				
Bay State Gas Co.—				
Stock	5,000,000	50	16⅛	16¼
Income Bonds	2,000,000	1000	23	25
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	74¾	76
2d " " "	3,000,000	1000	50	51
Buffalo Mutual, N. Y.	750,000	100	120	—
" Bonds	200,000	1000	95	100
Chicago Gas Company	25,000,000	100	70⅞	71
Chicago Gas Light & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	93	93½
Consumers Gas Light Co., Jersey City	2,000,000	100	70	75
Bonds	600,000	1000	94	98
Cincinnati G. & C. Co.	7,000,000	100	—	203¾
Consumers Toronto	1,600,000	50	184½	187
Central, S. F., Cal.			90	100
Capital, Sacramento, Cal			—	50
Consolidated, Balt.	11,000,000	100	62¾	63⅛
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	85	101
Bonds	250,000		—	—
Detroit Gas Co.	4,000,000	.....	18	—
Con. Bonds	4,312,000	.....	—	—
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	—	101
Fort Wayne Gas Co.	.....		74	75
" Bonds	.....		81	82
Hartford, Conn	750,000	25	120	128
Indianapolis Gas Co., Ind.—				
Stock	.....		135½	137
Bonds	.....		101¾	—
Jersey City	750,000	20	190	200
Lafayette Gas Co., Ind.				
Stock	.....		83	—
Bonds	.....		86	—
Louisville, Ky	2,570,000	50	125	130
Laclede Gas Light Co. St. Louis, Mo.—				
Common Stock	7,500,000	100	25½	26
Preferred "	2,500,000	100	82	84
Bonds	9,034,400	1000	93	94
Little Falls N. Y.	50,000	100	—	160
" Bonds	25,000	—	—	100
Montreal, Canada	2,000,000	100	200	208
New Haven, Conn		25	200	—
Oakland, Cal			42⅜	43
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	108
2d "	2,500,000	1000	104	105
Peoples, Jersey City	500,000	—	167	175
" " Bonds			—	—
Paterson, N. J.		25	99	102
Rochester, N. Y.		50	80	85
Preferred			81	—
Bonds			—	—
Syracuse, N. Y.	500,000	25	—	—
San Francisco Gas Co. San Francisco, Cal.	10,000,000	100	72⅜	72¾
Washington, D. C.	2,000,000	20	240	—
Western Gas Co., Milwaukee—				
Stock	.....		44	45
Bonds	.....		83¾	84¾
Wilmington, Del.	500,000	50	188	190

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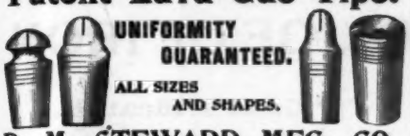
Patent Lava Gas Tips.



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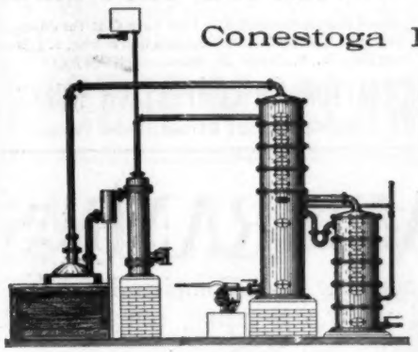

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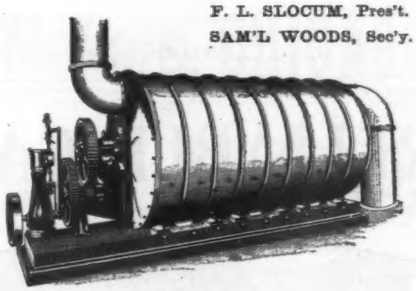

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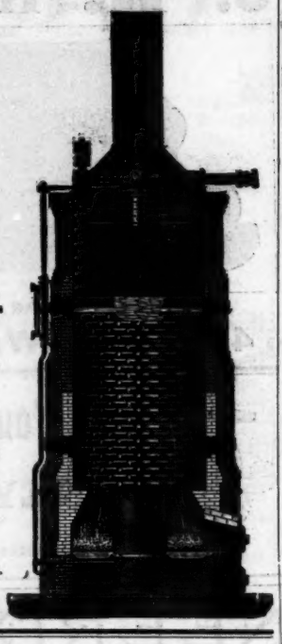

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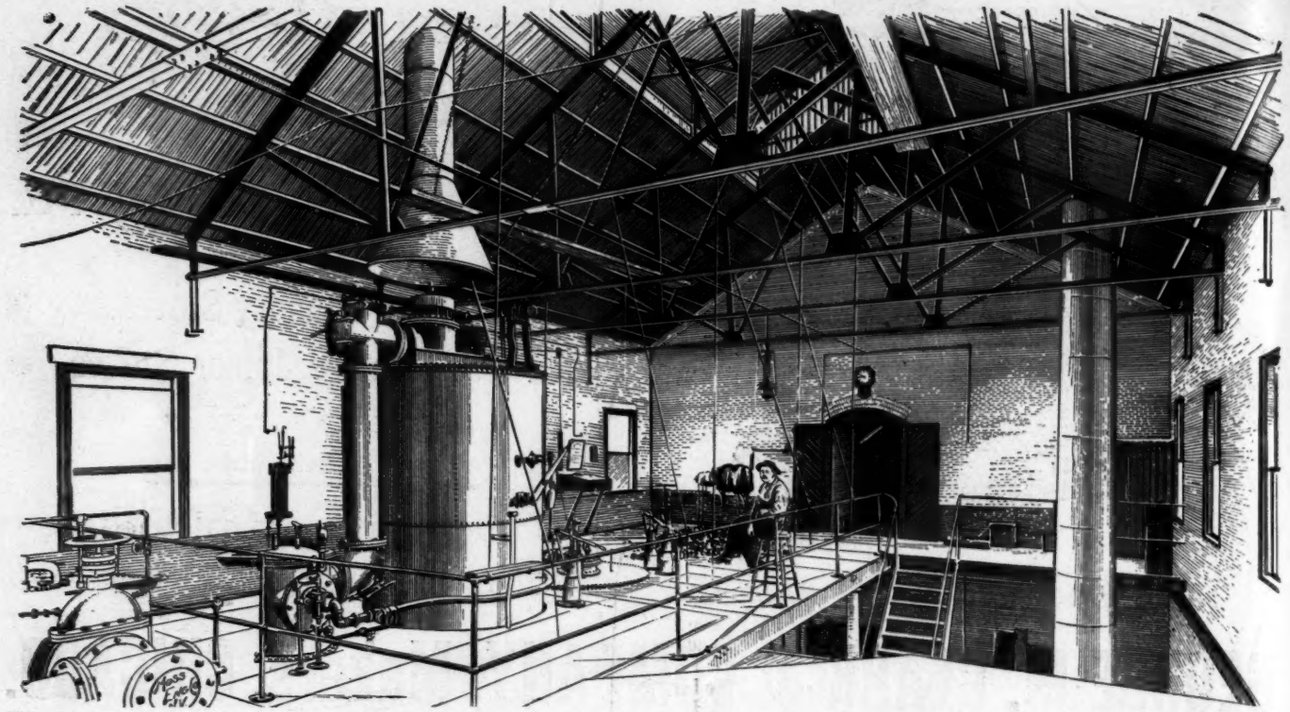

The above illustration is taken from a photograph, and shows the Machine Room of the New Bedford Gas Co., at New Bedford, Mass. The Roof on this building was furnished by us. The building is 32 feet in width by 50 feet in length, the Roof being made entirely of iron—that is, iron trusses and iron purlins covered with corrugated iron. The room is ventilated by a wrought iron ventilator extending the full length of the building, with corrugated shutters on each side opening and closing by cords from the floor.

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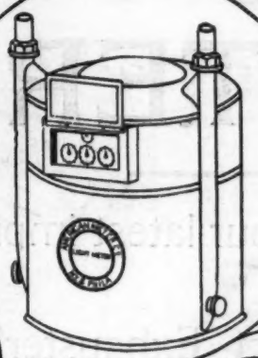

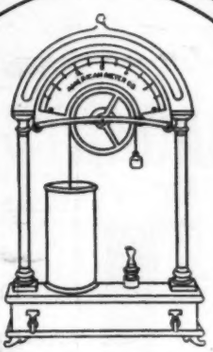

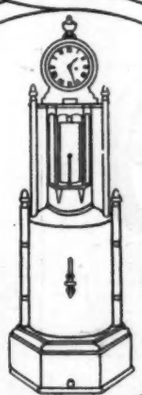

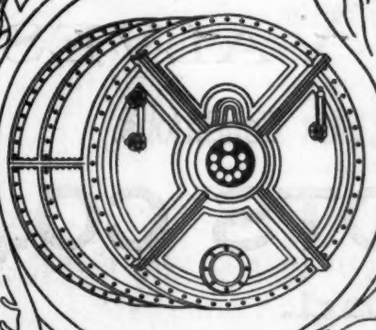

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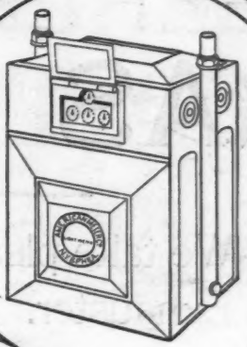

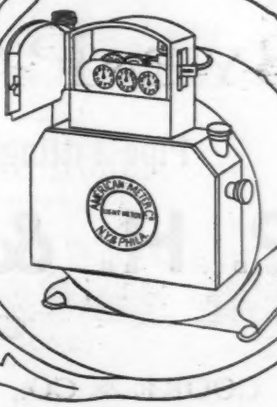

PUBLIC LIGHTING TABLE.

MARCH, 1895.

Day of Week.	Date.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish.	Table No. 2. NEW YORK CITY. ALL NIGHT LIGHTING. Light.	Extinguish.
				P.M.	A.M.
Fri.	1	10.10 PM	5.40 AM	5.30	5.45
Sat.	2	11.20	5.40	5.30	5.45
Sun.	3	12.20 AM	5.30	5.30	5.45
Mon.	4	1.30 FQ	5.30	5.30	5.45
Tue.	5	2.30	5.30	5.40	5.35
Wed.	6	3.20	5.30	5.40	5.35
Thu.	7	4.00	5.30	5.40	5.35
Fri.	8	4.40	5.30	5.40	5.35
Sat.	9	No L.	No L.	5.40	5.35
Sun.	10	No L. PM	No L.	5.40	5.35
Mon.	11	No L.	No L.	5.40	5.35
Tue.	12	6.40 PM	9.10 PM	5.50	5.20
Wed.	13	6.40	10.30	5.50	5.20
Thu.	14	6.40	11.40	5.50	5.20
Fri.	15	6.40	12.50 AM	5.50	5.20
Sat.	16	6.40	2.00	5.50	5.20
Sun.	17	6.40 LQ	3.00	5.50	5.20
Mon.	18	6.40	3.50	5.50	5.20
Tue.	19	6.40	4.30	6.00	5.10
Wed.	20	6.40	5.00	6.00	5.10
Thu.	21	6.40	5.00	6.00	5.10
Fri.	22	6.40	5.00	6.00	5.10
Sat.	23	6.40	5.00	6.00	5.10
Sun.	24	6.50	4.50	6.00	5.10
Mon.	25	6.50 NM	4.50	6.00	5.10
Tue.	26	6.50	4.50	6.10	4.55
Wed	27	6.50	4.50	6.10	4.55
Thu.	28	6.50	4.50	6.10	4.55
Fri.	29	6.50	4.50	6.10	4.55
Sat.	30	10.20	4.50	6.10	4.55
Sun.	31	11.20	4.40	6.10	4.55

TOTAL HOURS LIGHTING DURING 1895.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	237.00	January	423.20
February	196.40	February	355.25
March	195.50	March	355.35
April	165.30	April	298.50
May	153.40	May	264.50
June	138.20	June	234.25
July	146.30	July	243.45
August	152.50	August	280.25
September	165.10	September	321.15
October	186.10	October	374.30
November	204.10	November	401.40
December	219.30	December	433.45
Total, yr.	2161.20	Total, yr.	3987.45

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It is without question the most perfect Exhauster ever constructed.

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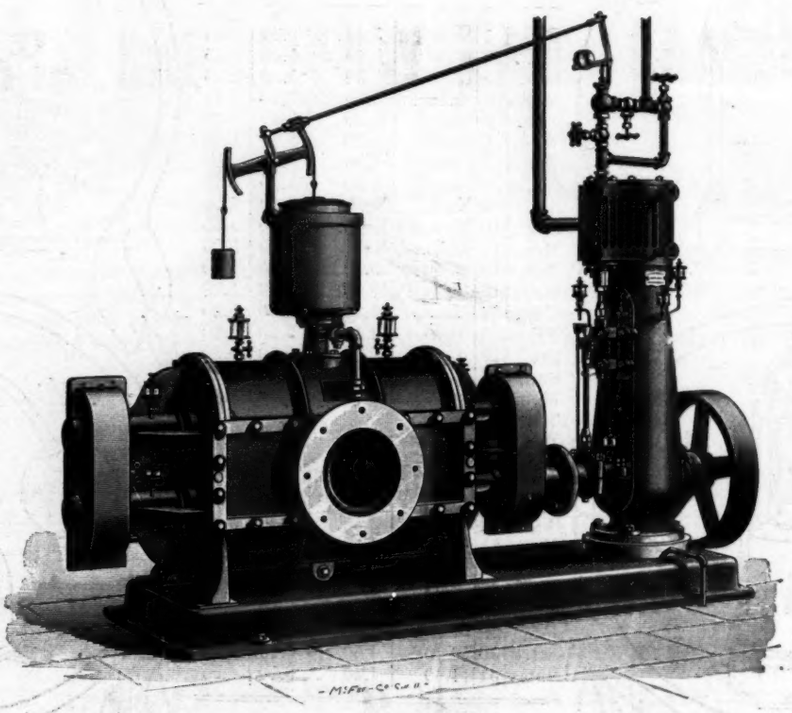

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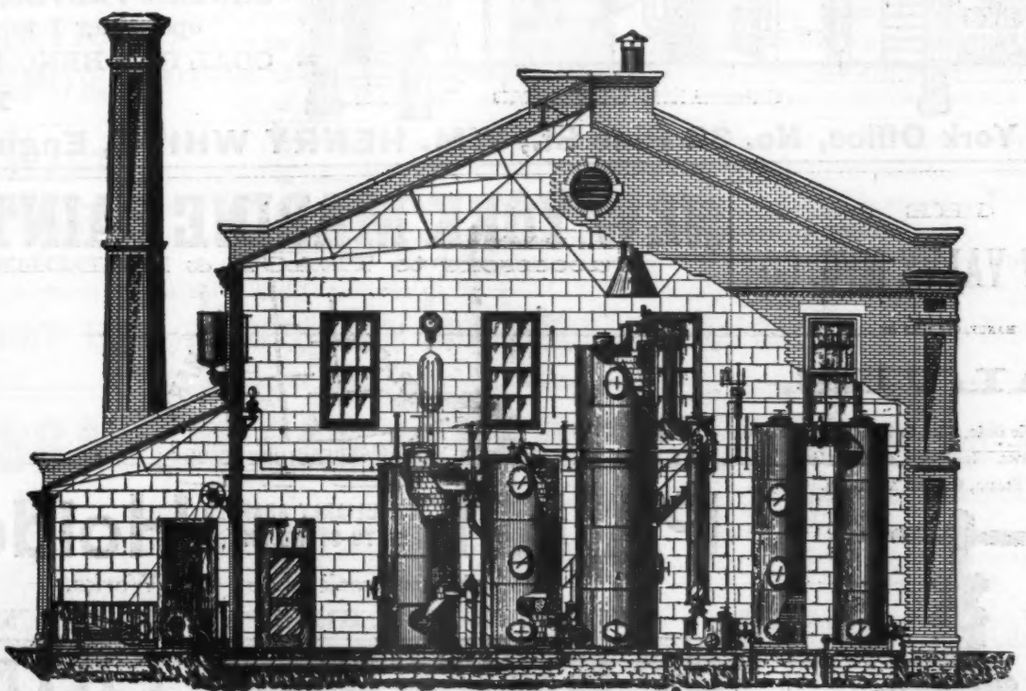

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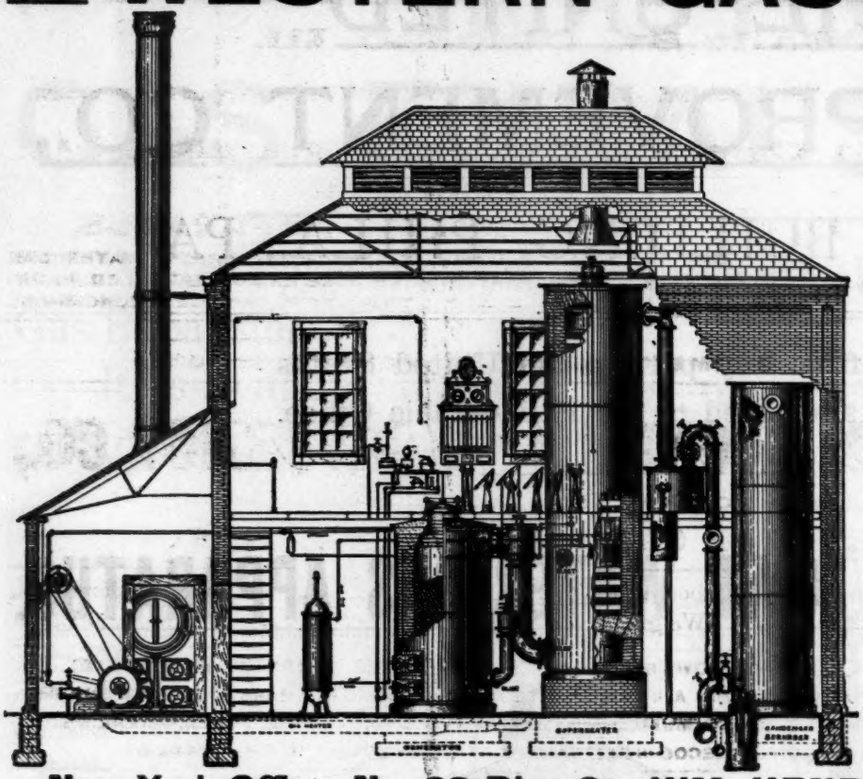

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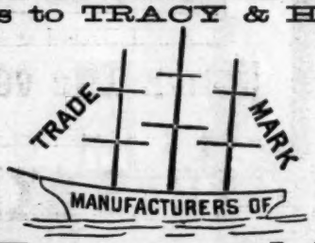

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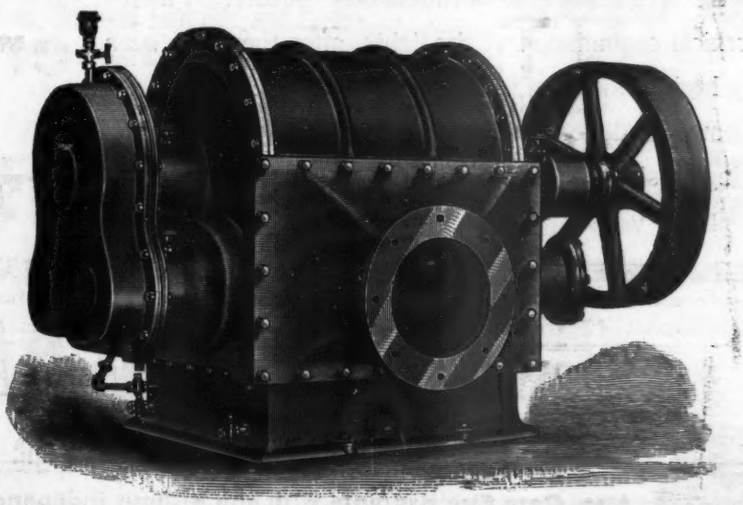

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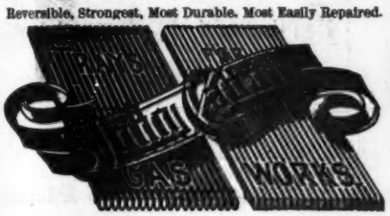

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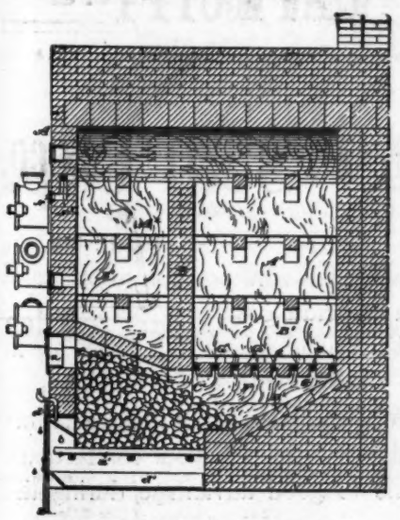

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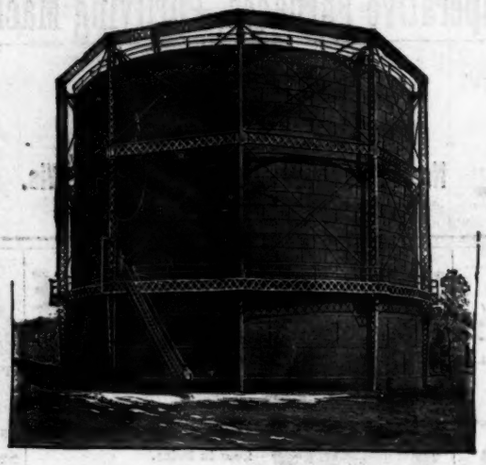

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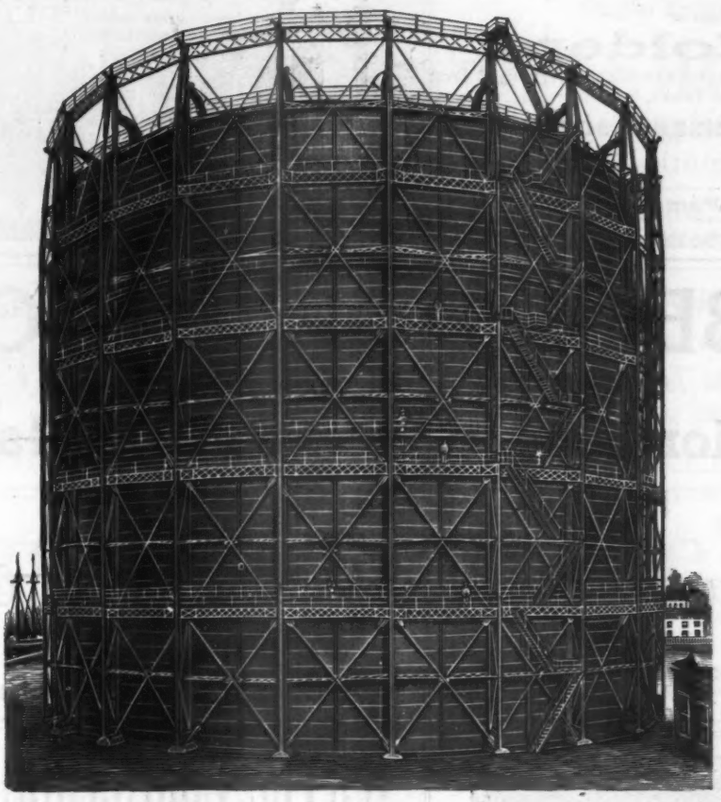

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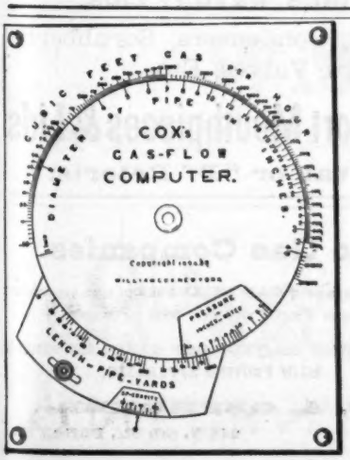

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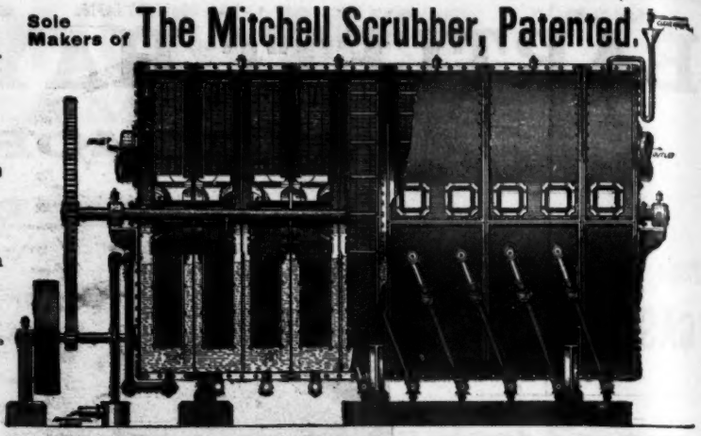

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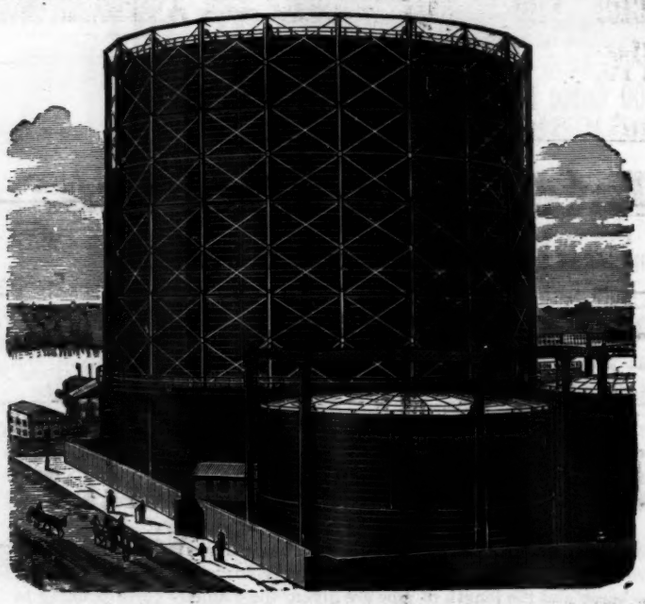

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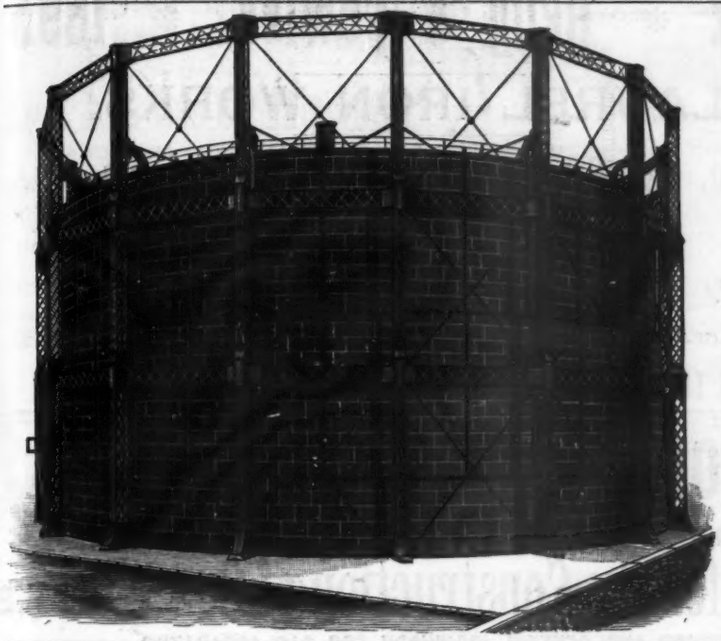

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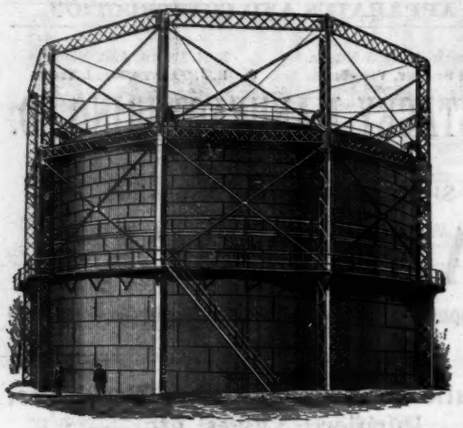

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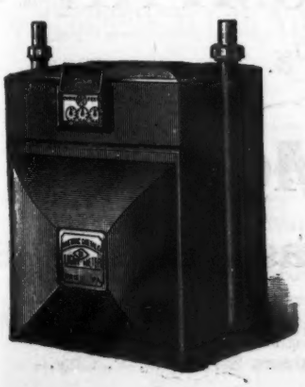

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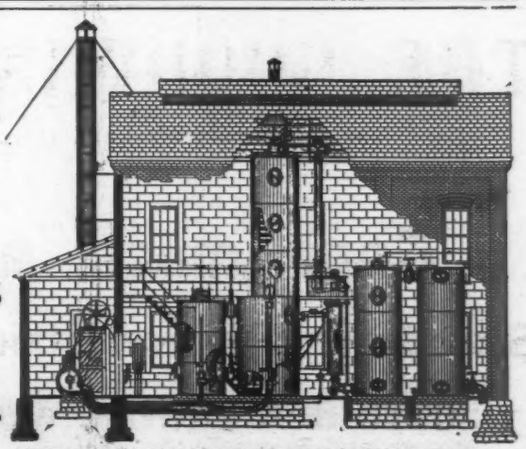

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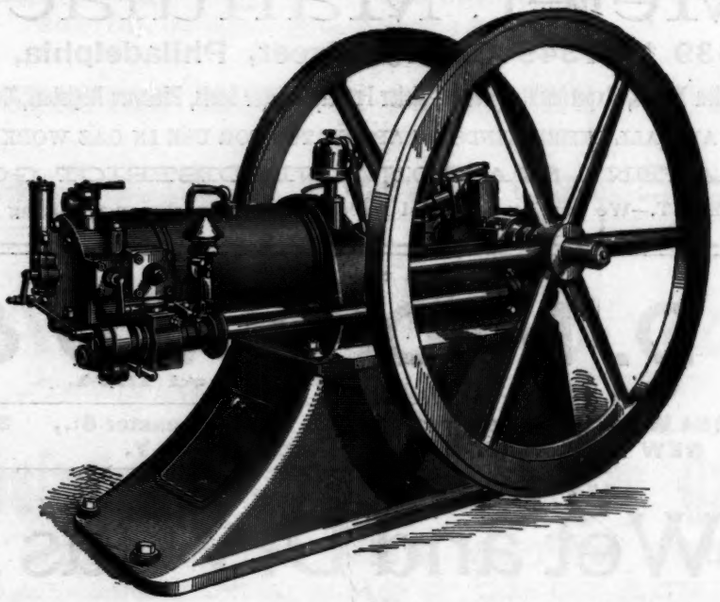

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